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412

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THE POPULAR EDUCATOR.

LESSONS IN ETHNOLOGY.—I.

INTRODUCTION—TRANSMISSION OF QUALITIES, ETC.

THE term Ethnology is derived from two Greek words, *ethnos* (*eth-nos*), a body of men, a nation, caste, or race; and *logos* (*log-os*), a word, discourse, etc. It is the science which treats of the races of mankind. It was formerly called Ethnography, the second part of this word being taken from *graphein* (*graph-o*), I engrave, I write. Ethnography then was a writing about, or a description of, the races of the world. As, however, inquiries on this subject have of late taken a wider range, and assumed a more scientific aspect—it being held needful now not merely to describe the characteristics of a race, but also to attempt to discover how those characteristics arose—Ethnology, the latter part of which is derived from the same root as the word *logic*, has become the more appropriate term. A cognate science is Anthropology, and it is necessary to distinguish between the two. According to Dr. Latham, anthropology specially investigates the relation in which man stands to the inferior animals; but this is too limited a view. For what is the etymological construction of the word *anthropology*? It is made up of *anthropos* (*an-thro-pos*), *man*, and *logos*, meaning (as already explained) *discourse*. Anthropology, then, is a discourse about man, and its cultivators profess "to study man in all his leading aspects, physical, mental, and historical, to investigate the laws of his origin and progress, to ascertain his place in nature, and his relation to the inferior forms of life." Such, at least, is the comprehensive programme of the Anthropological Society of London, which, founded in 1863, succeeded, within a short space of time after its foundation, in battling its way into public notice. Ethnology would, then, be one department of the great science of anthropology, and this we deem the correct view.

Having now traced out the limits of the field, it is needful next to enter on its exploration. No two members of the same family come into the world in all respects alike, and the original differences grow more, instead of less manifest, as the young people advance to maturity. When at length they go forth to push their way in the world, perhaps one enters the Church, another the army, and a third the navy; while a fourth goes out to India, returning home only in the evening of his days. To the original differences have now been superadded others resulting from diversity of climate, food, habitation, profession, and mental and moral habits. The modifications of colour and general appearance produced by the tropical climate on that member of the family who spent the best years of his life in India will be specially apparent. Every one knows that, in all likelihood, he will be darker than his compeers. As colour is one of the points on which the various races of men depart widely from each other, it should be noted how great are the alterations in this respect which can be effected by ordinary influences, even within the first generation. A traveller, speaking from observation, says that a European acquires a tawny skin by residing for some time in Egypt, and a bronzed one by living in Abyssinia; he becomes pallid on the Arabian coast, of an unhealthy white in Syria, clear brown in the deserts of Arabia, and ruddy in the Syrian mountains. Nay, more, his hair becomes darker, acquires a softer texture, and shows a tendency to curl. It will be perceived that the changes in the colour and in the texture of the hair constitute an approach, however faint, to a race of mankind more remote than any other from the European.

A second and important question now arises. Are slight differences of organisation among members of a family, either appearing by some occult law at birth, or produced at a subsequent period by various natural causes, transmitted from one

generation to another? The answer must be that they are so, though not uniformly, yet at least occasionally. In various works, among which we would instance one—Dr. Theodor Waitz's excellent "Introduction to Anthropology," edited in English by J. F. Collingwood, Esq., Hon. Secretary of the Anthropological Society—much important evidence is adduced with regard to the descent of natural or acquired peculiarities to the second, if not to remoter generations. For instance, an officer whose little finger had accidentally been cut across, and had in consequence become crooked, transmitted the same defect to his offspring. Another officer, wounded at the battle of Eylau, had his scar reproduced on the foreheads of his children. When the newborn infants of Europeans are compared with those of savage nations, the shape of the toes in the former is found to have been modified by the fact that their parents were in the habit of wearing shoes. It has often been observed that the Hapsburg, or Austrian royal family, for some generations back, have had a thick upper lip, which first appeared after an ancestor of theirs had intermarried with the Polish family of Jagellon. A gentleman communicates the information that he has himself witnessed a single white lock of hair in two successive generations of a family, which family moreover bore a surname that may possibly have been first suggested by the phenomenon now described. Observations analogous to those which have just been recorded have been made also in the case of the lower animals. We have space for only two. In Carolina, a dog which had accidentally lost its tail transmitted the defect to its descendants for three or four generations. A sheep in Massachusetts, with a long body and short legs, in 1791 became the progenitor of an apparently permanent breed, possessing the same characteristics. This now occurs in various parts of North America, is called the otter sheep, and is prized by farmers, as its short limbs prevent its being able to leap over the fences. It is thus abundantly evident that physical peculiarities are transmissible both in the case of man and of the lower animals. So are instincts, temper, etc., in animals, and mental and moral qualities in man. A vicious horse generally breeds another of the same kind; a docile one similarly repeats itself. Children among ourselves generally take after their parents. True, numerous instances have occurred in which a wise man has begotten a fool, or the son of a poet has been prosaic to the last degree, or the first-born of an eminent naturalist has cared nothing for his distinguished father's pursuits. But it is not by any means always so; witness, for example, the Hookers, father and son, both of the highest eminence in botany. The two sets of facts may be harmonised by remembering that the sons who departed so widely from their fathers' mental characteristics, may in this respect have closely resembled their mothers. In many cases the intellect of an able man is inherited from his mother, so much so, that, as has been pointed out, the popular phrase is not *father-wit*, but *mother-wit*. There is, then, nothing in what has now been stated to overthrow the observation that mental and moral qualities can be transmitted from parents to children. Nay, more; when mothers have had to pass through scenes of terror—like some of those which arose in connection with the first French revolution—the fright in which they have been has in some cases told on the intellect of any children to whom they may have shortly afterwards given birth; thus new mental types may be created by passing events. So, also, training laboriously imparted to dogs, tends to become to them a second nature, and more or less to modify the instincts of their offspring; there being in this, as in similar cases, a certain analogy between man and the inferior animals. With such a law of variability operating during thousands of years, it was inevitable that diverse races should

தெய்வத்தாய் புகழ்
செப்பெருவதற்காக எடுத்த
2. கண்ணாடி
செப்பெருவதற்காக எடுத்த
கொள்வப்பட்டு நாளி
சிவலட்சுமி 1995
செப்பெருவதற்காக எடுத்த
புதுச்சேரி 1995
சுற்றுலா துறை
புதுச்சேரி
கொள்வப்பட்டு நாளி
புதுச்சேரி 1995

appear both among mankind and the other members of the animated creation now inhabiting the world.

But here we are met by the highest question in ethnology. Can it be established on strictly scientific evidence, that the several types of mankind have had a common origin? Or have they from the first been totally distinct? Before entering on this inquiry, some terms, which it will be necessary to employ in the argument, must be defined. All who have any acquaintance with natural science have at least a general idea what a species means, though modern investigations have rendered it for the present almost impossible correctly to explain it. Till lately, nearly all naturalists held that each species of animals or of plants was produced by a separate act of creation, and that the number could not be increased unless by a fresh exertion of creative power. Then each species could vary within certain limits, and even give rise to types which might be mistaken for new species, but were designated varieties. Nay, more, there were sometimes crosses, called hybrids, between distinct species; but these, it was held, could not perpetuate themselves, but speedily died out, unless kept up by new intercommunion between the parent species. Crosses between mere varieties were occasionally termed mongrels. These explanations being made, readers will thoroughly understand the nature of the question—Are the several types which we see among mankind distinct species? or are they simply permanent varieties? In other words, had the European and the negro a common parent? or were they from the first totally distinct? The ethnologist does not consider it legitimate to go beyond the limits of his special science, and ask whether or not revelation has decided the point, but confines himself to strictly scientific evidence.

It was formerly held that there was decisive proof derivable from natural science in favour of the unity of the human race. This was the nature of the argument employed:—Hybrids between distinct species are unable permanently to propagate themselves. For instance, the mule, which is a hybrid between the horse and ass, is incapable of continuing its race. If the European and the negro were distinct species, the race intermediate between them—we mean the mulatto one—would be a hybrid, and, if left to itself, would speedily become extinct. Yet it does not do so, but holds its own. Therefore it is not a hybrid between two species, but a mongrel between two varieties of one species; and the negro and European differ from each other only as permanent varieties in other parts of Nature do. A good deal of weight still attaches to this argument, but not at all so much as was once believed. The doctrine that hybrids are never fertile has of late been impeached in two quarters. Darwin has done so with great ability in his extensively circulated works; and ethnologists of the American school—some of them, however, possibly influenced by the disturbing effect exerted by the "irrepressible negro" on social and political life in the United States—have for a considerable number of years maintained the same view. Darwin believes that the domestic dogs of the world did not come from one, but from several species; yet they show none of that tendency to die out which the law of hybridism was supposed to require. The origin of dogs is, however, a point on which differences of opinion may exist. It is therefore important to observe that there have been fertile hybrids known between animals so undeniably distinct as the stag and the cow, the swan and the goose, and various other animals. Singularly enough, those species which are most closely allied have had fewer fertile hybrids between them than others which are more remote. So far as is at present known, some hybrids perpetuate their race, and others do not. If the law of hybridity is thus complex, then the argument which is founded on it, with respect to the close affinity of the European and the negro, is considerably weakened, though still it is not divested of all its force.

Another objection has been made to the validity of the argument. It has been stated that the mulatto race is a feeble one, which soon dies out; and that thus it manifests the weakness of hybridity. Dr. Nott of America maintained this, with respect to the mulattoes of South Carolina, when he resided in that part of the United States; but he saw reason to modify his views when some time afterwards he went to Mobile, New Orleans, Pensacola, and other places on or near the Gulf of Mexico. There he found a far stronger and healthier race of

mulattoes than he had seen in South Carolina, which he accounted for by saying that the fathers of many of them—Fr. Spaniards, and other members of the Latin race—had a greater affinity with negroes than the Anglo-Saxons possessed. The hybrid doctrine, was not this likely to produce results, the opposite of those observed? As has been said, there are so many mulattoes in Brazil, that if the race had manifested tendency to die out, the fact would before now have been perfectly apparent.

It was once maintained by a careful observer (Flourens) that the negro must needs be specifically distinct from the European since the former possessed, between two layers of his skin, an organ containing a dark pigment, or colouring matter, differing not in hue simply, but in structure, from the white man. But Flourens afterwards abandoned this view, and took up the common one—namely, that the black pigment in the negro is deposited in the same layer of skin as it is in the white races of India, who, ethnologically viewed, are quite distinct from the African races; nay, more, in the same layer which receives the colouring matter when a native of this count becomes somewhat bronzed by exposure to a tropical sun. Besides, the negroes themselves vary greatly in colour, the extreme type with which we are familiar being indigenous on the low, moist parts of Central Africa, while the inhabitants of the hills are considerably lighter. Both in Sierra Leone, and the States of America the children of negroes in contact with civilisation tend somewhat to advance in intellect and improve in personal appearance. Should the process go on for a few generations, the result would at last be very considerable.

We believe that the majority of the ethnologists of Europe still hold the unity of the human race, whilst others, such as M. Broca of Paris, whose work on hybridity has been translated into English, and edited by Dr. Carter Blake, Assistant Secretary of the Anthropological Society, take the contrary view. Many Americans, as already stated, agree with Broca. The preponderance of opinion among scientific ethnologists is apparently still, however, in favour of that doctrine long ago enunciated by the Apostle Paul in his address delivered on Mars Hill before the Athenian Areopagus. "He [God] hath made of one blood all nations of men for to dwell on all the face of the earth."

LESSONS IN ITALIAN.—XXXIII.

IRREGULAR VERBS OF THE FIRST CONJUGATION.

THE Irregular Verbs are those which deviate in some tenses and persons from the regular verb of the same conjugation which is given for their model.

The first irregular conjugation contains only *andare, dare, fare, stare*, and their derivatives.

As all Italian verbs may be generally conjugated with or without personal pronouns, we now think proper to omit them in the conjugation of the irregular verbs, feeling confident that the student is thoroughly acquainted with them. For a similar reason we omit the conjugation of the compound tenses, which the reader now will be easily able to form and conjugate for himself.

1. The irregular verb *andare*, to go, is thus conjugated:—

Inf. Simple Tenses.—Pres. *Andare*, to go.—Pres. Gerund. *Andando*, going.—Past Part. *Andato*, andata, andata, andata, gone.—Compound Tenses.—Past. *Essere andato*, to have or be gone.—Past Gerund. *Essendo andato*, having or being gone.

Ind. Pres. *Vado* or *vo*, *vai*, *va*; *andiamo*, *andate*, *vanno*.—Imp. *Anda*, *andavi*, *andava*; *andavate*, *andavano*.—Ind. Pret. *Andai*, *andasti*, *andò*; *andammo*, *andaste*, *andarono*.—Fut. *Andrò*, *andrai*, *andrà*; *andremo*, *andrete*, *andranno*.—Cond. Pres. *Andrei*, *andresti*, *andrebbe*; *andremmo*, *andreste*, *andrebbero*.

Imp. *Va*, *vada*; *andiamo*, *andate*, *vadano*.
Sub. Pres. *Che vada*, *che vada* or *vadi*, *che vada*; *che andiamo*, *che andate*, *che vadano*.—Imp. *Che andassi*, *che andaste*; *che andassimo*, *che andaste*, *che andassero*.

After this example conjugate *riandare*, to go again.

2. The irregular verb *dare*, to give, is thus conjugated:—

Inf. Simple Tenses.—Pres. *Dare*, to give.—Pres. Gerund. *Dando*, giving.—Past Part. *Dato*, *dato*, *dato*, *dato*, given.—Compound Tenses.—Past. *Avere dato*, having given.

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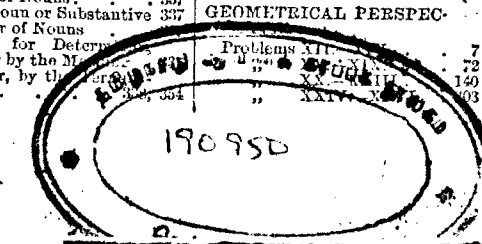
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POPULAR EDUCATOR.

LESSONS IN GEOLOGY.—I.

INTRODUCTION—DIVISIONS OF THE SUBJECT—PHYSICAL GEOLOGY—THE GEOLOGICAL SYSTEMS—MINERALOGY AND LITHOLOGY—THE SOLAR SYSTEM, ETC. ETC.

The derivation of the word Geology (*γη* [*ghee*], the earth, and *λόγος* [*logos*], a discourse, or a reasoning) indicates the main direction of the science. It confines its attention to a description of the solid crust of the earth, and to the elucidation of those forces and causes which have produced the changes the surface of our planet has undergone. To aid him in his investigation, the geologist needs the aid of the botanist, the zoologist, the chemist, the mineralogist, the physicist, and even of the mathematician.

Although the subject looks formidable to the general reader, it is not only fraught with the deepest interest, but by far its greatest part may be traversed by common sense. Moreover, its study commends itself to all, since it requires no expensive apparatus, nor yet a preparation which all other sciences demand ere the student can enter on their practice. Young and old, gifted with observation, may at once become practical geologists; and by never passing a stone-heap without an examination, or never leaving a quarry or gravel-pit unsearched, they will soon lay the foundation of a geological cabinet, and be efficient labourers in the extension of geological research.

Every generation of our race has produced men of inquiring minds, and it is but natural that such men should turn their research to discover the origin of the world we inhabit, especially in the early times when but few channels were opened along which they were invited to expend the natural vigour of their intellect; hence, in the earliest records of eastern nations we find theories which attempt to account for the existence of our earth—these it is unnecessary to dwell upon.

It is evident that the only sound mode of procedure is to collect all the information which observation of the various existing phenomena of nature can give; to search the crust of the earth for any facts which the rocks, their position, their character, their fossil contents, can afford; to notice the arrangement of continents and seas, the position and directions of mountain chains, etc., and from these letters of the geological alphabet to spell out the history of our globe.

The history of the progress of geology, like that of any other science, can furnish many instances of theories built up without any facts for foundations; but as patient research gradually amassed information, these erroneous suppositions were abandoned, and geologists have, from so many warnings, become extremely careful of hazarding opinions. The experiences, by which we have been taught not to speculate, though interesting and instructive, we cannot record in these pages, as our limited space requires us to attend to facts and the deductions which may be reasonably drawn from them.

The division of the subject we propose is the following:—

1. *Physical Geology*—that is, the geological agencies which have worked the various changes in the surface of our planet, both as to their present existence and as to the traces of their power which the rocks reveal.

2. *The Geological Systems*.—As we pass through these, we shall enumerate the fossils the rocks contain, the history of the animal and vegetable life of our globe, and the localities in which the members of these systems appear.

3. *Mineralogy and Lithology*.—In our last division we hope to describe the composition of the various kinds of rocks, as well as the physical and chemical properties of the minerals they contain.

Before we enter upon the immediate province of geology, it will be well to consider our position in the universe, and somewhat of the character of our world as a globe, noticing the most

plausible of the theories yet produced to account for the construction of our system, and therefore of our earth.

The solar system, of which we are one of the members, consists of the sun and eight planets—four of which are very much larger than the earth—and a number of very small planets, called asteroids, which revolve in the space separating the four exterior and larger planets from the interior and smaller ones. The position of the earth is the third from the sun. The earth is accompanied by a moon, which is not the case with any of the other interior planets, whilst the exterior planets are all attended by satellites—Saturn and Uranus by eight, Jupiter by four. All these bodies revolve round the sun in the same direction, and all move within a narrow belt. The exterior planets are much lighter than the interior. If the density of water be taken as 1, the density of the sun will be about 1½; of Mercury, 2½; of Venus, 5½; of the Earth, 5½; of the Moon, 3½; of Mars, 3½; of Jupiter, 1½; of Saturn, 1½; of Uranus, 2½.

The sun's magnitude is immense, as may be judged by the fact that if he were a hollow shell, and the earth placed at the centre, there would be sufficient room for the moon to revolve, as she now does, at 240,000 miles from the earth, and there would still be some 200,000 miles beyond the moon ere the shell of the sun were reached. The planets cannot be said strictly to revolve round the sun, but the sun and the planets revolve about the centre of gravity of the system; and, owing to the preponderating bulk of the sun, this centre of gravity lies not far from his own centre.

In searching for a record of the process of creation, we naturally turn our attention to that only Book the human library contains which did not emanate from the mind of man. But the Bible was not written as an instructor in physical science, hence we only find the sacred historian dedicating a few verses to the subject of "the creation of the world." Yet we may rest assured that, although the short notice only touches the prominent points, yet every word is true; and the more science has discovered, the more has she proved to be the commentator and unfold of the great truths contained in those few words.

A generation since, geologists were looked upon as the opponents of revealed truth, the friends and abettors of infidels and atheists; but now we have learnt not to generalise from too few facts, but patiently to explore before pronouncing a definite judgment. The interesting questions, "the development of species" and "the antiquity of man," are to-day in the same position as the questions of "the universality of the deluge" and "the six periods of creation" at the close of the last century. But we know in these days nothing of the rancour with which the contest was then carried on. Explorers now in every part of the world collect information, and every right-minded man rests assured that in the end Scripture will not be contradicted, but confirmed.

The chief points in the description of the creation given in Genesis will be found to be fairly explained by Laplace's nebular hypothesis, which has been extended to the explanation of the contour of the earth's surface. The first fiat of the creation was, "Let there be light." Now we are well aware that light is nothing more than the rapid vibration of an invisible existence called ether; so that our word "light" in the expression quoted must mean "light-giving matter." This corresponds to the fire-cloud of the hypothesis. All bodies of our acquaintance are capable of existing in a state of vapour. The temperature at which this change of state takes place is so high that the vapours are luminous. Hence the first fiat of creative power called into existence all the matter of which the solar system is composed in a state of highly luminous vapour. In the expression that "the light was divided from the darkness," there seems to be an

indication that the law of gravitation was imposed upon this vapour, and it began to revolve round its centre of gravity, thus collecting itself into a fire-cloud, whose outmost edge stretched beyond the orbit of our most distant planet. A moment's thought will decide that the shape it would take would be that of a watch, providing that the edges were somewhat thinner.

As this fire-cloud revolved in space, which is devoid of heat, it would rapidly cool. Obedient to the great law, as it cooled it would contract and become more dense, until its outward edge had reached so low a temperature that it could no longer remain in its vapour condition, when it would condense into a liquid.

The globe of red-hot matter thus produced has since lost all its heat, and forms the furthest planet of our system. So one after another the different planets condensed from the vapoury mass. As might be expected, they did so at intervals, regulated by a law, named, after its enunciator, "Bode's law." There are several points in our system which support this theory. The planets and their moons all move in the same direction. Their orbits are comprised in a narrow belt, which represents the thickness of the cloud. The exterior planets are light, and have many moons—both which peculiarities are accounted for by the fact that the cloud would be denser near its centre, and gradually become more rare towards its outward edge, in the region where these planets condensed. There yet remains a further confirmation: the existence of Saturn's ring and the asteroids. It is well known that matter in rotation, if it be sufficiently pliable, will assume one of two shapes—either a sphere or a ring. The sphere will not be perfect, but will flatten at its poles and bulge out at its equator in proportion to the rapidity of its motion and the slight cohesion of its matter. The exterior planets are so elliptical in their shape that, looking at them through a telescope, the eye is at once struck with the fact.

The earth's equatorial diameter is twenty-six miles longer than its polar. It has been suggested that this shape may be due to the denudation of the poles by the continued evaporation of water in the regions of the tropics and its condensation as rain at the polar regions. By this means a thickness of thirteen miles was gradually transported from the poles, and deposited at the equator. But if this were the case, the earth would still possess a spherical nucleus. This, however, is disproved by certain astronomical considerations concerning the motion of the moon. Hence, the earth must be elliptical from its centre—that is, its shape is due to the action of its rotation when its mass was pliable.

The ring is the only other shape which fluid in revolution can assume to be in equilibrium; but it is remarkable that if a ring of oil which collects round a wire shape, immersed in a spirit of the same specific gravity as the oil, be made to revolve by turning the wire, when a certain speed is attained the ring suddenly breaks up into innumerable globules.

The existence of the ring of Saturn proves that that planet must once have been in a fluid condition. The asteroids seem to have been a ring of much larger dimensions, which, as in the instance quoted, broke up into many small planets. The view with which they used to be regarded—namely, that they were fragments of a planet which some internal convulsion had shattered—is now abandoned; for it can be proved that in this case the fragments must periodically return to the point from which they were hurled, which is not the case.

In the lapse of untold ages the various members of our system condensed from this vapour-cloud, and in process of time cooled down, until, losing their heat, they ceased to be luminous, and assumed the appearance with which we are familiar.

The sun is the remnant of this cloud, which was the result of the Great Being's first command, and no doubt the condensation and contraction are still going on.

But to return to our earth. After our globe had assumed the liquid condition, the process of cooling would still proceed, and the consequent contraction. The result of this would be that the vast ball of molten matter would be covered with a solid crust or skin. This crust, owing to the greater contraction of liquids than solids, would wrinkle, and, seeing the earth possessed a uniform motion, the wrinkles would take a uniform direction: this direction was from north to south. Whether water was existing in the atmosphere which enveloped the earth, as highly rarefied steam or as its constituent gases, oxygen and hydrogen, in an uncombined state, is a matter of little moment.

For many ages the surface of the earth was too hot to permit water to rest upon it; but when the cooling had sufficiently proceeded to allow of this, then that vast quantity of fluid which is the blood of the geological life of the world covered the surface of hard bare rock from pole to pole. But for long ere this was effected, the water, in a state of condensed vapour, which forms clouds, must have enwrapped the earth, and the operation ascribed to the second period of creation was the making of a firmament which should divide the waters which were above the earth—the clouds—from the waters which were on the surface: meaning to say that the cooling had sufficiently proceeded to allow the water to remain on the surface, and clouds to form.

With the dawn of the third era began the operation of a force which still exists, and to which we shall frequently have to allude: the heaving up, gradual and slow, of the northern hemisphere, and the consequent draining off of the waters towards the southern pole. The ridges, or the crests of the wrinkles, which had a generally northern direction, being elevated at their northern extremity, would form continents of a triangular shape, the point of the triangle tending southwards. This appearance is still perpetuated in North and South America, Africa, India, etc. A glance at the map of the world will afford many confirmations of this theory; making allowance for the repeated elevations and immersions of the continents, which would necessarily cause some alteration in their shapes. This theory bears out the assertion of the sacred record, that the sun was not made until the fourth day—that is, Mercury and Venus were not until then separated from the mass, and that luminary which we call the sun produced as he now appears to us.

From this time the various forces which are still existing date the commencement of their operations. The tides, the ocean currents, the rivers, the streams, the rain, the atmosphere, all began their action on the Primary rocks, wearing them down, and redistributing their particles in homogeneous order along the ocean bed; here forming stratified rocks which imbedded the organic remains of that life which the Author of all life had so abundantly shed upon the now habitable earth. Whether, in after years, now facts discovered will cause another theory to supersede this, remains to be seen. As yet, this is the only supposition at all tenable. And now, leaving theory, it is our duty to describe in turn these different agents, to notice their present action, and to discover traces of their handiwork in the rocky pages of Nature's book.

LESSONS IN ARITHMETIC.—XXXVI.

SIMPLE INTEREST (continued).

9. Another method of finding the simple interest upon a given sum for any assigned NUMBER OF DAYS.

Let it be required to find the interest on £300 17s. 10d. for 218 days, at 5 per cent. per annum.

218 days is $\frac{1}{5}$ of a year.

Hence the answer would be given by simplifying the expression.

$$\frac{218}{365} \times 5 \left(\frac{£300 \ 17s. \ 10d.}{100} \right)$$

In questions where the time given is a number of days, it is manifest that the divisor 36500 will always occur. For a reason which will be explained immediately, twice this number, that is 73000, is a more convenient divisor, so that we must double the numerator of the fraction.

Now, $12 \times 218 \left(\frac{£300 \ 17s. \ 10d.}{100} \right) = £787132 \ 12s.$, so that the result will be obtained from $\frac{£787132 \ 12s.}{73000}$.

The division by 73000 may be effected as follows:—

It will be found that $1 + \frac{1}{3} + \frac{1}{5} + \frac{1}{15} = \frac{10000}{73000}$.

$$\begin{array}{r} \frac{1}{3} \ 73000 \\ \frac{1}{5} \ 24333\frac{1}{3} \\ \frac{1}{15} \ 4866\frac{2}{3} \\ \hline 10000 \end{array}$$

Hence, if to any number we add a third of itself, then $\frac{1}{5}$ th of that third, and again $\frac{1}{15}$ th of this last quotient, we shall in fact have multiplied it by the fraction $\frac{10000}{73000}$. If then we further divide by 100010, we shall have divided the number by 73000.

If, instead of dividing by 100010, we divide by 100000 (which is done at once by cutting off 5 decimal places to the right), we shall obtain a result which will be very nearly correct, being, in fact, too great only by $\frac{1}{1000000}$ of the sum divided;

for $\frac{1}{1000000} = \frac{1}{1000000} + \frac{1}{1000000000} = \frac{1}{1000000000}$, nearly.

Now, £10 = 9600 farthings, and $\frac{1}{1000000000} = \frac{1}{1000000000} = \frac{1}{1000000000}$, nearly.

Hence, to get our result correct to the nearest farthing, we must reject from it $\frac{1}{1000000000}$ of a farthing for every £10 which occurs in the original dividend. But since this dividend is 100000 times the result, it will be the same thing if we reject 1 farthing, for every £10 in the result.

Performing, then, this operation upon the above example—

$$\begin{array}{r} \text{£} \quad \text{s.} \quad \text{d.} \\ \frac{1}{10} \ 787132 \quad 12 \quad 0 \\ \frac{1}{10} \ 26237 \quad 10 \quad 8 \\ \frac{1}{10} \ 26237 \quad 15 \quad 0\frac{1}{2} \\ \hline \quad \quad \quad 2623 \quad 15 \quad 6\frac{1}{4} \\ \hline \text{£}1078713 \quad 13 \quad 2\frac{1}{4} \text{ and } \frac{1}{4} \text{d.} \\ \hline \quad \quad \quad 20 \\ \hline \quad \quad \quad 1567433 \\ \hline \quad \quad \quad 12 \\ \hline \quad \quad \quad 809198 \\ \hline \quad \quad \quad 4 \\ \hline \quad \quad \quad 36795 \end{array}$$

The operation gives £10 15s. 8d., and therefore, rejecting one farthing, since the result only contains £10 once, we find the result correctly to a farthing to be

£10 15s. 7 $\frac{1}{4}$ d.

Obs.—It does not necessarily follow that this method will be really the most convenient when the interest is to be found for a number of days. For instance, if the days reduce to a simple fraction of a year, it will be best to proceed by the ordinary method. The artifice is explained here as being a useful exercise for the student, and as an ingenious method which it may be sometimes useful to employ.

EXERCISE 55.

Find the interest upon:—

1. £1456 10s. 0d. for 131 days at 5 per cent.
2. 1000 0 0 for 201 days at 6 per cent.
3. 1698 14 8 for 189 days at 5 per cent.
4. 1478 8 6 for 20 days at 21 per cent.
5. 847 12 6 from July 8 to Dec. 26, at 5 per cent.
6. 987 18 9 from April 21 to Sept. 24, at 5 per cent.
7. 7597 10 8 from May 3 to Aug. 21, at 5 per cent.

COMPOUND INTEREST.

10. Where compound interest is reckoned, at the end of one year the interest is added to the principal. This amount becomes the principal for the second year, and the interest upon it comes the principal for the second year must be calculated and then added to its principal, and so on. The difference between the final amount at the end of a number of years, and the original principal, is the compound interest.

EXAMPLE.—To find the compound interest for 3 years on £100 at 5 per cent.

At the end of the 1st year the amount is	£105 0 0
The interest of this for the 2nd year is	5 5 0
At the end of the 2nd year the amount is	£110 5 0
The interest on this for the 3rd year is	5 10 3
At the end of the 3rd year the amount is	£115 15 3
Hence the compound interest gained in 3 years is	£15 15s. 3d.

In finding the compound interest upon any sum, this is the process which must be followed. It will therefore readily be seen that, when the number of years is large, and the principal and rate per cent. complicated, the operation will be very laborious. All questions of compound interest are very much facilitated by the use of *Logarithms*, of which, however, we cannot treat here.

Tables of the compound interest upon £1, at different rates per cent., and for different numbers of years, are constructed for practical use.

EXERCISE 56.

EXAMPLES IN COMPOUND INTEREST.

1. Find the compound interest upon £350 for 3 years, at 5 per cent.

2. Find the compound interest upon £555 10s. for 2 years at 4 per cent.
3. Find the difference between the simple and the compound interest upon £250 for 4 years at 6 per cent.
4. Find the difference between the simple and the compound interest upon £365 4s. 8 $\frac{1}{2}$ d. for 3 years at 4 per cent.
5. Find the compound interest upon £250 for 3 years at 2 $\frac{1}{2}$ per cent.
6. Find the compound interest upon £1040 for 3 years at 4 per cent.
7. Find the compound interest upon £625 for 2 years at 4 per cent.
8. The difference between the compound and simple interest of a sum for 3 years at 4 per cent. is 19s.; find the sum.
9. I buy a field for £1000, for which I receive £30 a year rent, which I invest as soon as received at 4 per cent. compound interest. At the end of 3 years I sell it again for £1030. What have I lost or gained by buying the field instead of investing the purchase-money on the same terms as I did the rent?

KEY TO EXERCISE 54, LESSON XXXV. (Vol. II., page 403).

1. £21.	9. £413 1s. 3 $\frac{1}{2}$ d.	17. £121 4s. 9 $\frac{1}{2}$ d.
2. £43 14s. 9 $\frac{1}{2}$ d.	10. £679 14s. 0 $\frac{1}{2}$ d.	18. £225.
3. £84 13s. 7 $\frac{1}{2}$ d.	11. £1204 6s. 3 $\frac{1}{2}$ d.	19. 4 years (a).
4. £148 15s. 5 $\frac{1}{2}$ d.	12. £6812 17s.	20. £1 3s. 11 $\frac{1}{2}$ d. $\frac{1}{2}$.
5. £101 6s. 7 $\frac{1}{2}$ d.	13. 21 $\frac{1}{2}$ years.	21. 25 years.
6. £326 1s. 2d.	14. 8 $\frac{1}{2}$ years.	22. 3 $\frac{1}{2}$ per cent.
7. £100 2s. 6 $\frac{1}{2}$ d.	15. 2833 years.	23. 4 per cent. per annum.
8. £75 11s. 6 $\frac{1}{2}$ d.	16. £280.	

THE HISTORY OF ART.

XII. TITIAN AND THE ECLECTICS.

FROM the days of Raffael and Michel Angelo onward, the history of art becomes mainly the history of the different national or sectional schools into which painting was divided. The general progress of all the fine arts grows too wide to follow in detail, and it is therefore necessary to confine ourselves to the great central art alone. Perfect technical mastery of the principles of painting had now been generally acquired. After Raffael and Michel Angelo, the mere handicraft of the artist could be taught almost mechanically, so that the veriest tyro could draw with a wooden accuracy and a fidelity to life which would have astonished the careful but undeveloped mediæval painters. The varieties that could now arise were mainly those of a more delicate, intimate, and personal sort, dependent not so much upon differences of technical mastery as upon differences of taste or fancy. Every one could now learn the principles of perspective, of anatomy, and of *chiaroscuro* (or light and shade), but everybody had not the fancy, the feeling, and the power of touching our higher and finer chords which mark the really great painter; for the artist works with his brains and his heart as well as with his fingers. It was in these matters of feeling and taste that the greatest differences were henceforth to be noticed. Moreover, art now began to split itself up into many classes or kinds. Hitherto we have heard nothing of landscape, nothing of any kind of art not religious; and we have dealt with Italy almost exclusively, leaving out of consideration Germany, France, the Low Countries, and England. Henceforth, however, we get, not a continuous stream of development in one country, but a divergence of art into many separate lines. During the Middle Ages, painting was all devotional in subject, and all given over to the delineation of the human figure. From the days of the Renaissance onward it has gone on multiplying its subjects and its aims in every direction. It has divided itself into historical, domestic, landscape, still life, and innumerable other branches, and each of these has been variously cultivated in various countries and by various schools. It is obvious that we can only glance very briefly here at the most important and most characteristic of these.

Even during the lifetime of Michel Angelo and Raffael, a second great school of art, distinct from the Roman and the Florentine, was growing up in Italy itself—at Venice. This school dated back into the Middle Ages, but it attained ripeness at the same time as that of Florence. Tiziano Vecellio, whom we in England ordinarily call Titian, was two years the junior of Michel Angelo, being born in 1477; but, as he attained the great age of ninety-nine years, he considerably outlived even

his famous contemporary. Titian more especially devoted himself to portrait painting, and held the office of painter by appointment to the doges, or chief magistrates, of the Venetian republic. He was patronised by the great emperor Charles V., whose portrait he twice painted; and it is said that he accompanied the emperor to Spain for some years. But the greater part of his life was spent in Venice itself, where most of his finest pictures still remain. The great point of Titian's work is the exquisite beauty and purity of his colouring, for which he is generally considered to rank absolutely first. There is a grand stateliness and dignity about his portraits which are to be found in few others. He has rendered for us in undying colours the noble heads of the great Venetian statesmen—the proud and wealthy leaders of a great merchant oligarchy—whose haughty features and splendid mien exactly suited his grandiose and princely style. The austere faces, the broad and portly yet magnificent figures, the stately robes, the Italian profusion of velvet and silk, all seemed as though designed on purpose for his pencil. Titian's main importance in the general history of art, indeed, depends most especially on the fact that he is the earliest great painter whose claims rest chiefly upon his portraits, and not upon devotional works or idealised figure-pieces. He painted, however, many pictures in these other lines, among which the "Sleeping Venus," in the Dresden Gallery (familiar in numerous engravings), is perhaps the best known to most English people. He took a great many subjects also from classical literature, such as the "Bacchus and Ariadne," "Venus and Adonis," and "Rape of Ganymede," all in our own National Gallery. But he also chose others of

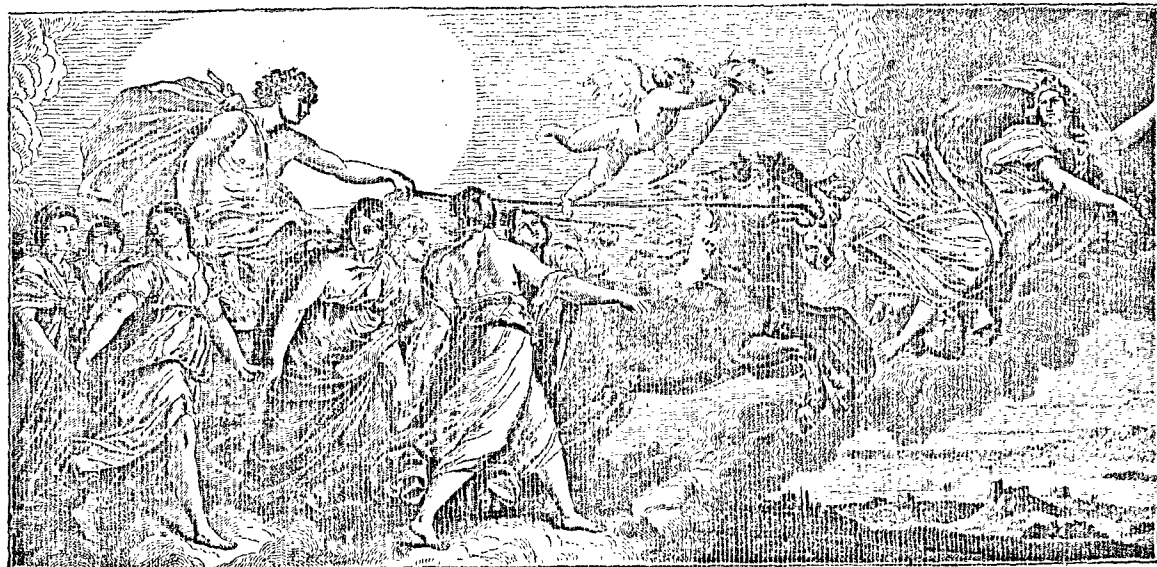


TITIAN.

Titian founded a large school of painters at Venice, most of whom were his own pupils; and the peculiar richness of colouring which they learned from their master was one of their distinguishing traits. Among them the most distinguished was perhaps the painter whom we know as Tintoretto, and who to some extent combined the Roman and Venetian manners, imitating Titian in colouring and Raphael and Michel Angelo in composition. He may thus be considered as one of the earliest eclectic painters, who form the next great school that we must briefly consider.

With the general development of science, civilisation, and intercourse which took place during the sixteenth century, a change began to come over the spirit of the various small local schools. Painters no longer spent the greater part of their time in one city, but went about from town to town, studying the masterpieces of their various predecessors. In this way, what is known as the eclectic school took its rise; its great endeavour being to combine the diverse excellences of the acknowledged masters. A large number of separate circumstances conduced to the growth of the eclectic spirit. Towards the close of the sixteenth century, Italy and the world at large were fast being revolutionised. The mediæval system was now thoroughly broken down, and the modern system was rapidly

taking its place. Spain had already made her great conquests in the New World, and the minds of men were filled with visions of the El Dorado opening before them across the Atlantic. Portugal had discovered the route to India round the Cape of Good Hope, and was in the heyday of her colonial greatness. These new paths of commerce and adventure were opening out



AURORA AND PHŒBUS, WITH THE HOURS. (By Guido Reni.)

the mediæval devotional sort, such as the "Martyrdom of St. Sebastian," the "Assumption of the Virgin," and the "Death of St. Peter Martyr." These are less happy, as a rule, than his magnificent representations of his own Venetian contemporaries.

new ideas in turn. England was waking up to her Elizabethan revival, her poetic glories in Shakespeares and Spenser, and her naval adventures under Drake and Raleigh. Protestantism had spread over all Germany and the North, and was even then engaged in a life-and-death struggle with Catholicism in France.

In the midst of all this great upheaval, this widening and broadening of human thought and interests, art alone could not remain stationary. It ceased to be local, and began to be cosmopolitan, as schools of painting sprang up in every part of Europe. It was no longer dependent upon the building of a particular cathedral or palace, upon the patronage of a particular pope or king: it had become a thing of general popular interest and concern. All over Europe the big mediæval castles, with their gloomy courts and bare halls, were giving place to the stately Italian style of mansions, with terraced gardens, noble porches, broad staircases, long airy galleries, and large windows admitting abundance of light and sunshine. Their walls were adorned with portraits of the noble families and their friends, while their ceilings were covered with frescoes of graceful and fanciful classical subjects. In such a world as this, art began to assume a more popular form; it gave up its severity and austerity. At the same time, it lost much of its primitive sincerity; it learned to appeal to more commonplace and perhaps even vulgar feelings. No longer addressing itself to the taste of a few educated and cultivated connoisseurs alone, it sought to catch the public eye by somewhat tricky sentiment and meretricious beauty. It was from such causes that the school of the eclectics took its rise.

The most famous of the early eclectics were the family of Caracci at Bologna, of whom Ludovico Caracci (born 1555, died 1619) and his cousin Annibale (1560—1609) are the best known. Ludovico was a pupil of Tintoretto, and he followed his master in the attempt to combine the various good points of the preceding schools. Annibale studied under Ludovico, and was afterwards employed upon the Farnese Palace at Rome. Both painters had much beauty of technical workmanship, but their works are marked by a certain false sentiment and theatrical action which please inexperienced judges at first sight, but which a critical eye recognises as inferior in tone to the closer fidelity and simplicity of the early Renaissance artists. The classical spirit is very strong in their works, most of which are drawn from the old mythology. They are treated, however, in a rather meretricious manner, with much superficial grace, and a good deal of posing and posturing. During the eighteenth century, indeed, when artificiality was rather a recommendation than otherwise, it was the fashion to talk of the Caracci and the other eclectics as representing almost the highest development of modern painting. At the present day, on the other hand, when the prevalent taste runs rather in the direction of a revived mediævalism—when the real beauties of the pre-Raphaelite painters are fully recognised, and when their obvious shortcomings are too readily overlooked or condoned—it has become the fashion to run down the eclectics to an unmerited extent, as being mere pretenders or false sentimentalists of a vulgar sort. It is probable that a just and true criticism would steer somewhere between these two extremes. It would admit that the Caracci and their school were wanting in the highest mental qualities of the true artist; that they sacrificed too much to theatrical effect, and lacked deep spiritual insight; but on the other hand it would frankly recognise the great merits of their work in its technical aspect, and the beauty and tenderness of many of their pictures.

No one of the eclectics has suffered more in reputation from this marked revulsion of feeling in modern times than Guido Reni, undoubtedly the greatest and truest of the eclectic school. A century since, it was usual to speak of Guido as occupying the same rank as Raphael, Michel Angelo, Leonardo, and Titian; at the present day it is usual to speak of him with a mixture of contempt and dislike, which have in them something almost of personal bitterness. Yet Guido, with many faults of sentiment and taste, is certainly one of the painters whose works have most deeply touched the hearts of thousands upon thousands of men; and the exquisite tenderness and grace of some of his works ought easily to redeem the occasional trickiness and false romance of his less pleasing pieces. Guido was a native of the Bologna district, and a friend of the Caracci family. His style has an extraordinary softness and grace of its own, a delicacy of touch and melting tone of colouring which are to be found in no other painter. The faces of his women and children in particular are full of a child-like simplicity and beauty which are very touching. He loved best to paint female faces, and those of the softest and most lovable kind. The Magdalen was his favourite subject, and perhaps the one in which he

succeeded most fully. He also took many beautiful heads of women from his own Roman peasantry. In men's figures he chose rather such subjects as the dead Christ, or other touching themes on which he might display his peculiar tenderness; and it is this love for pathetic display which has raised against him the charge of sentimentality. His "Ecce Homo," in the Dresden Gallery, is familiar to every one in numerous engravings, while the exquisite female portrait which bears (erroneously) the common title of the "Beatrice Cenci" is almost equally well known. The English National Gallery contains a large number of his works. Our illustration represents his "Aurora and Phœbus, with the Hours," preserved in the Rospiglioli Palace, which is generally considered as his masterpiece, but which perhaps represents his peculiar characteristics far less strikingly than most of his other works.

With the eclectic school the peculiar greatness of Italy in art began to decay. Painting and its sister arts now migrated westward, as did also trade, manufactures, science, and the political centre. The discovery of America and of the new route to India turned away the current of the world from Italy and the Mediterranean to England, France, Holland, and the Atlantic. The wealth which used to flow into Venice, Florence, Genoa, Rome, and the Tuscan cities began to flow into London, Paris, Antwerp, and Amsterdam. All that was living in politics, in philosophy, in literature, in thought, followed in the westward stream. The minds of men took a new direction. Spain was the first of the nations on the Atlantic sea-board to feel the change; and to blossom into a short-lived greatness; but the effects of the movement extended rapidly to France, England, and the Low Countries as well. Hence it is in these countries that we must henceforth look for the chief development of art. With the great age of Raphael and Michel Angelo, Italy had reached her culminating point; with the Caracci and Guido the decay had begun to set in; and from that time forward the artistic supremacy rapidly deserted Italian soil, and began to fix itself further to the west.

It is always so in art. Artistic greatness can never live on without the other kinds of greatness upon which it bases itself. The painter, the sculptor, and the architect are all products of their age: they are acted upon by all its thought, all its science, all its industry, all its wealth. It would be absurd to expect great painters or great sculptors to arise in the Greece of the present day. There is none of the active environment by which such greatness is begotten. On the other hand, in the Greece of the age of Pericles, in the Italy of the age of Raphael, there were all the necessary elements in abundance. Minor arts were being carried on everywhere; churches or temples were being built; palaces were being decorated; wealth was being spent in encouraging hundreds of the smaller artistic handicrafts. By such pursuits, men were trained to the kind of occupations from which families of painters or sculptors arise. For all these tastes and talents are hereditary, the long result of many ages of previous culture. With the beginning of the seventeenth century the scene of civilisation had shifted, and Italy began to fall behind in the race. Since that time, she has been the great school for artists, because she still possesses all the greatest artistic achievements of her best age; but she has seldom or never herself again produced an artistic genius of the first order.

LESSONS IN GREEK.—XIV.

REVIEW OF THE THREE DECLENSIONS.

WITH the nouns of the first and second declension, the student, if he has thoroughly mastered the foregoing lessons, will find no difficulty in any attempt he may make to construe classical Greek. It is somewhat different with nouns of the third declension, the discovery of the nominative of which is necessary in order to consult a Greek lexicon with ease and effect. I therefore subjoin the following, which will enable him from the genitive case to find the nominative; in which form substantives and adjectives appear in dictionaries. I give the genitive, because the genitive is, as it were, the key to the remaining oblique cases. Thus, if you meet with *ἀνδρα*, you know the genitive must have two of those letters, namely, *δρ*; if you meet with *χρῖμας*, you know the genitive will have the letters *χρῖμα*; if you meet with *μελας*, you know the genitive will have the letters *μελαν*. Now, from the genitive you may get

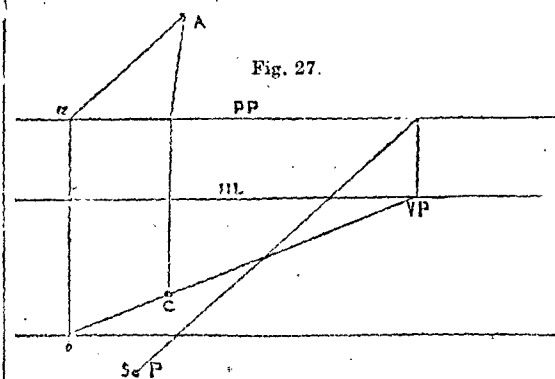


Fig. 27.

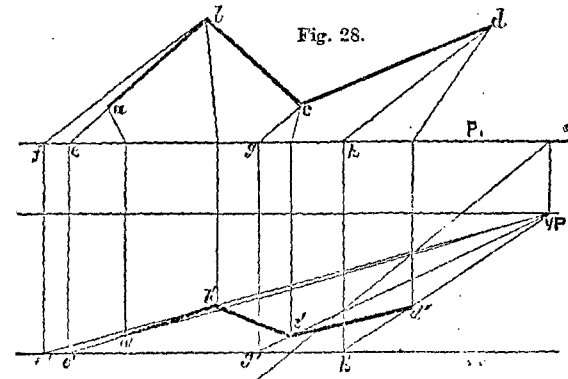


Fig. 28.

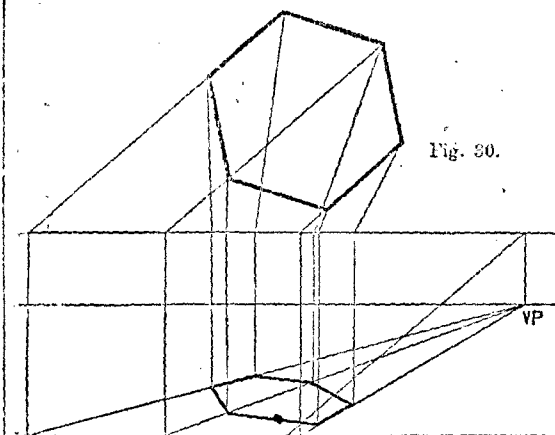


Fig. 29.

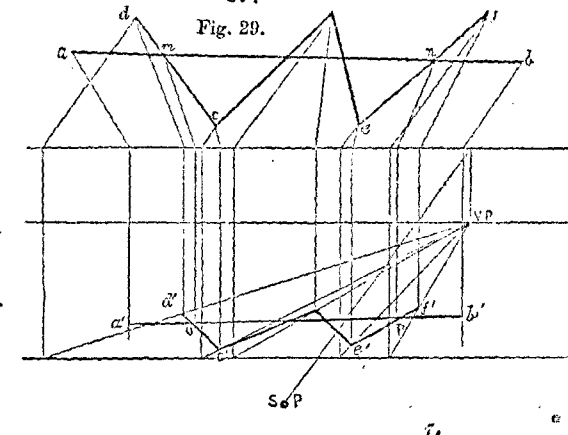


Fig. 30.

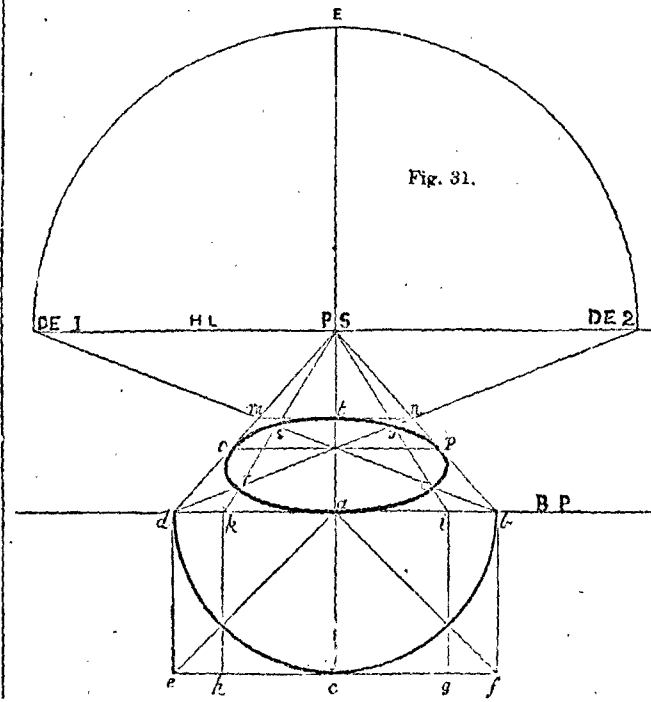


Fig. 31.

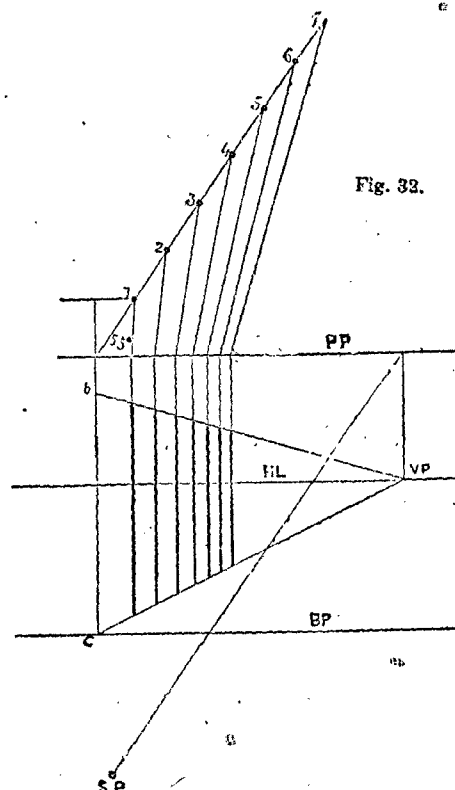


Fig. 32.

purpose of placing before our pupils one or two cases to show how this principle, when put into practice, will simplify the work in many questions which may appear to be difficult. Let the pupil turn to Prob. I, Fig. 7 (Vol. II., p. 225)—of course we presume that this problem has been learnt, and, for the sake of practice, lines have been placed at other angles and worked out also—because this problem contains the key to the whole theory of ground-plan perspective. Now, if the pupil consider for a moment the principle exemplified in that problem of putting a line only into perspective, he will see that it is nothing more than finding the positions of c and b . For as a straight line extends between the two points in the plan, therefore, when the perspective of these two points is determined by drawing a line between them, we shall have the perspective of the line. In order that we may be fully prepared to go further into the subject, we will take a point only, independent of any line, and place its plan anywhere beyond the r r , Fig. 27. Let A be the point. From A draw a line at any angle with the r r , and meeting it in a . Find the vanishing point of a A , bring down the point of contact a perpendicularly, to b , and join b v r ; a visual ray from A cutting this line will give the perspective position of A at c . We will now make an application of this principle, and show how, with only one vanishing point, we may work out a problem which in plan is composed of a great number of lines, and none of them parallel with each other. We will propose a very simple case (Fig. 28), composed of three lines a b , b c , and c d . Draw a line a e from a to the r r , and from the extremities of each line draw others parallel with a e ; find the v r for one of these lines, which will be the v r also for the rest, because parallel retiring lines have the same v r ; bring down the points of contact e , f , g , h , to b r , the base of the picture, and then join them with the v r . Upon these last lines respectively will be the perspective positions of the points or extremities of the lines a b c d found by the visual rays as in Fig. 27, viz., a' b' c' d' ; unite these points by straight lines corresponding with the plan, and then will be produced the perspective view of that represented by the plan. The pupil must practise this by giving himself a similar combination of lines, and of greater number. We will add another position of line to this figure. A line, a b , is drawn across the arrangement already shown in Fig. 28, so we will proceed to explain the method of representing the line a b . It will be understood that the perspective of c d is c' d' and of e f , e' f' . Now the given line a b crosses these lines in the plan through m and n ; it will be necessary, then, to find the projection of these points m and n , which will be done if visual rays are brought down from these points to cut the perspective lines c' d' in o , and e' f' in p ; then, to complete the problem through these points o and p , the line a' b' must be drawn to the extent each way as determined by visual rays from the extremities a and b . These figures may in themselves have no particular meaning, we merely employ them to illustrate a principle, because the perspective of any other object of an intelligible character may be worked out by this method.

Fig. 30 is the plan of a hexagon (see Lessons in Geometry XIX., Problem LI., Vol. II., page 192), having one of its edges at an angle of 20° with the r r . We will only give the figure, and recommend the pupil to work it out; afterwards he should make other regular or irregular polygons for practice also. Remember that a regular polygon is one that has all its sides and

all its angles equal; an irregular polygon has unequal sides and unequal angles.

PROBLEM XII. (Fig. 31).—To draw the perspective of a circle. Diameter of the circle, 4 feet; height of eye, 5 feet; distance of the eye from the r r , 10 feet, and opposite the centre of the circle. Scale, $\frac{1}{2}$ inch to the foot. Draw the r r and also the h h 5 feet above it; anywhere (at a) draw the semicircle b c d , with a radius of 2 feet; from a erect a perpendicular to r r , and from the point where this line cuts the h h in r s describe the semicircle e b 1 , e' d 2 , with a radius equal to the distance of the eye from the picture plane. About the semicircle d c b describe the rectangle d e f b ; draw a e , a f , and through the points in the semicircle cut by the lines a e and a f , draw the lines g i and h k parallel to a c or d e . From the points d , b , a , i , b , draw lines to the r s . Draw a line from d to d 2 , and also one from b to d 1 , and call them distance lines; notice where these last lines cut b r s and d r s , between these intersections the line m n must be drawn. We have now a square in perspective, in which the circle is to be drawn. Through the intersection of the distance lines draw o p parallel to m n . With the hand draw through the points t , u , p , q , a , r , o , s , to t again, the perspective circle required. This latter part of the process—that is, drawing the circle—will be the most troublesome; as it does not admit of the use of compasses, it must be done by the hand only, and will require much practice to do it neatly.

PROBLEM XIII. (Fig. 32) is the first example of elevations. A row of 7 rods, perpendicular to the ground, 6 feet high, and 1 foot apart; the plan 55° with the picture plane. Their distance apart must be arranged in the plan 1, 2, 3, 4, 5, 6, 7; their heights must be set off on the line of contact, b c ; therefore a line drawn from c to the v r will represent their retiring position on the ground, and a line from b to the v r will represent the perspective of their heights; their widths apart will be found by the visual rays drawn from 1, 2, 3, etc., on the plan.

PROBLEM XIV. (Fig. 33).—A cube 4 feet edge has one of its faces at an angle of 40° with the r r ; its nearest angle touches the r r . Draw the plan of the cube a b c d , making d c at an angle of 40° with r r . Find the vanishing points of the sides a d and d c , viz., v r 1 and v r 2. Proceed as in Prob. VII., Fig. 19, for the extent of the base. For the elevation, as the cube touches the r r at d , therefore a perpendicular line from d brings down the point of contact to e , making the line d e the line of contact. As all heights are measured upon the line of contact, therefore the height of the cube must be represented by e f equal to d c (as all the edges of a cube are equal). Draw lines from f and e to each vanishing point; then the visual rays from a and c will determine the outer and perpendicular edges of the cube g h and i k . Again, as parallel retiring lines have the same vanishing point (and opposite sides of a cube are parallel), draw a line from i to v r 1, and another from g to v r 2, where these lines intersect at m will complete the upper horizontal face of the cube, viz., g f m i . Make all these lines dark as in the diagram.

To find the perspective of the centres of any of the faces of the cube, it will be only necessary to draw the diagonals on the faces of the perspective projection—viz., from f to h and i to e , or from f to b and g to e . If a line is required to be drawn across the centre of a face, in a horizontal position, the above central point must first be found, and then the line must be drawn through this point to the v r of the face respectively.

Fig. 33.

READINGS IN FRENCH.—I.

LE SAPEUR DE DIX ANS.

SECTION I.

Il y avait (a) en mil huit cent douze au neuvième régiment de ligne, un petit tambour qui n'avait que dix ans.² C'était un enfant de troupe (b) qui s'appelait Frolot de son véritable nom,³ mais que les soldats avaient surnommé Bilboquet.⁴ En effet, il avait un corps si long, si maigre et si fluet, surmonté d'une si grosse tête,⁵ qu'il ressemblait assez à l'objet dont on lui avait donné le nom;⁶ Frolot ou Bilboquet, comme vous voudrez (c), n'était pas au reste (d) un garçon autrement remarquable. Le tambour-maitre lui avait si souvent battu la mesure sur les épaules⁷ avec sa grande canne de junc, que l'harmonie du ra et du gla avait fini par lui entrer dans la tête et dans les mains. Voilà tout. Mais il ne portait pas le bonnet de police suspendu sur l'oreille droite,⁸ comme les moindres fifres le faisaient (e); il ne savait (f) pas marcher en se dandinant, à l'exemple de ses supérieurs,⁹ et un jour de paie qu'il avait voulu laisser pendre son sabre par devant, comme les élégants du régiment, il s'était embarrassé les pieds en courant et était tombé sur son nez,¹⁰ qu'il s'était horriblement écorché,¹¹ à la grande joie de ses camarades. On risait (g) beaucoup de lui,¹² qui ne risait de personne.¹³ Aussi avait-il dans ses habitudes un fond de sauvagerie et d'éloignement¹⁴ bien rare à son âge.¹⁵

COLLOQUIAL EXERCISE.

Each question to be answered by the pupil in French. The reference numbers in the text indicate the replies to the questions in the Exercises.

- | | |
|--|---|
| 1. Quel était le régiment du petit tambour? | 9. Marchait-il comme ses supérieurs? |
| 2. Quel âge avait-il? | 10. Que lui était-il arrivé un jour de paie? |
| 3. Comment s'appelait-il? | 11. Quelle avait été la conséquence de sa chute? |
| 4. Comment les soldats l'avaient-ils surnommé? | 12. Se moquaient-ils de lui? |
| 5. Pourquoi l'avaient-ils surnommé Bilboquet? | 13. Risait-il des autres? |
| 6. À quoi ressemblait-il? | 14. Qu'avait-il dans ses habitudes? |
| 7. Quel traitement le tambour-maitre lui faisait-il éprouver? | 15. Ce caractère est-il commun aux enfants de l'âge du petit tambour? |
| 8. Imitait-il ses camarades dans la manière de se coiffer? (h) | |

NOTES.

- | | |
|--|------------------------------------|
| (a) Il y avait, there was. | (e) From faire. |
| (b) Enfant de troupe, soldier's child. | (f) From savoir. |
| (c) From vouloir. | (g) From vivre. |
| (d) Au reste, besides. | (h) Se coiffer, to put on his cap. |

SECTION II.

Un jour, c'était le vingt-sept juillet¹ mil huit cent douze, le général reçoit (a) de l'Empereur l'ordre de s'emparer d'une position² qui était de l'autre côté d'un énorme ravin.³ Ce ravin était défendu par une batterie de six pièces de canon,⁴ qui enlevait des files entières de soldats, et pour arriver à l'endroit qu'avait désigné l'Empereur, il fallait s'emparer de cette batterie.⁵ À ce moment, le régiment de Bilboquet était sur le bord de la Dwina;⁶ car l'histoire que je vous rapporte s'est passée dans la fameuse campagne de Russie.⁷ Tout à coup, on voit arriver au grand galop (b) un aide-de-camp du général, qui apportait l'ordre à deux compagnies de voltigeurs de s'emparer de cette batterie.⁸ C'était une opération hardie⁹ où il y avait à parier (c) que périraient plus des trois quarts de ceux que l'on y envoyait; aussi les voltigeurs, malgré leur intrépidité, se regardèrent-ils entre eux¹⁰ en secouant la tête et en haussant les épaules: on en entendit même quelques-uns et des plus anciens, qui dirent tout bas en grognant et en montrant les canons—

"Est-ce qu'il croit (d), le général, que ces cadets-là (e) crachent (f) des pommes cuites?"¹¹ On bien est-ce qu'il a envie de nous servir en hachis aux Cosaques, qu'il nous envoie (g) deux cents contre cette redoute?"¹²

"Soldats!" s'écria l'aide-de-camp, "c'est l'ordre de l'Empereur;" et il repartit au galop.¹³

"Il fallait (h) donc le dire tout de suite,"¹⁴ dit alors un vieux sergent en assujettissant sa baïonnette au bout de son fusil: "allons, allons, il ne faut (i) pas faire attendre le Petit Caporal (j); quand il vous a dit de vous faire tuer il n'aime pas qu'on hésite."¹⁵

COLLOQUIAL EXERCISE.

- | | |
|---|---|
| 1. Quel était le jour du mois? | 9. L'opération était-elle dange-reuse? |
| 2. Quel ordre le général avait-il reçu? | 10. Que firent d'abord les voltigeurs? |
| 3. Où était la position? | 11. Que dirent-ils en montrant les canons? |
| 4. Comment le ravin était-il défendu? | 12. Quel nombre envoyait-on contre la redoute? |
| 5. Que fallait-il faire pour arriver à l'endroit désigné? | 13. Que leur répondit l'aide-de-camp? |
| 6. Où était alors le régiment de Bilboquet? | 14. Que dit le vieux sergent après le départ de l'aide-de-camp? |
| 7. À quel endroit cette histoire s'est-elle passée? | 15. Qu'ajouta-t-il en parlant du Petit Caporal? |
| 8. Quel ordre apportait l'aide-de-camp? | |

NOTES.

- | | |
|---|--|
| (a) From recevoir. | (e) Ces cadets-là, those fellows, i.e., the cannons. |
| (b) Au grand galop, at full speed. | (f) Crachent, send forth. |
| (c) Il y avait à parier, one might easily think; lit., one might bet. | (g) From envoyer. |
| (d) Est-ce qu'il croit, does he think? | (h) From falloir. |
| | (i) A name given by the soldiers to the Emperor. |

SECTION III.

Cependant il entra (a) encore quelque hésitation dans la compagnie,¹ et déjà deux fois le capitaine qui commandait-avait donné l'ordre au tambour-maitre de prendre deux tambours, de se mettre en avant, et de battre la charge.² Celui-ci restait appuyé sur sa grande canne,³ hochant la tête et peu disposé à obéir. Pendant ce temps Bilboquet, à cheval (b) sur son tambour⁴ et les yeux levés sur son chef, sifflait un air de fifre et battait le pas accéléré avec ses doigts.⁵ Enfin l'ordre venait d'être (c) donné une troisième fois au tambour-maitre, et il ne paraissait (d) pas disposé à obéir,⁶ lorsque tout à coup, Bilboquet se relève, accroche son tambour à son côté, prend ses baguettes,⁷ et passant sous le nez (e) du tambour-maitre, il le toise avec orgueil, lui rend d'un seul mot toutes les injures qu'il avait sur le cœur, et lui dit, "Viens (f) donc, grand poltron!"⁸

Le tambour-maitre veut (g) lever sa canne,⁹ mais déjà Bilboquet était à la tête des deux compagnies,¹⁰ battant la charge comme un enragé (h). Les soldats, à cet aspect, s'avancent après lui et courent vers la terrible batterie.¹¹ Elle décharge d'un seul coup ses six pièces de canon, et des rangs de nos braves voltigeurs s'abattent et ne se relèvent plus.¹² La fumée, poussée par le vent, les enveloppe, le fracas du canon les étourdit; mais la fumée passe, le bruit cesse un instant, et ils voient (i) debout, à vingt pas devant eux, l'intrépide Bilboquet battant la charge,¹³ et ils entendent son tambour,¹⁴ dont le bruit, tout faible qu'il soit, semble narguer tous ces gros canons qui viennent (j) de tirer. Les voltigeurs courent toujours, et toujours,¹⁵ devant eux le tambour et son terrible rran rran les appelle; enfin une second décharge de la batterie éclate et perce d'une grêle de mitraille les débris acharnés des deux belles compagnies.¹⁶ À ce moment, Bilboquet se retourne et voit qu'il reste à peine cinquante hommes des deux cents qui étaient partis,¹⁷ et aussitôt, comme transporté d'une fureur de vengeance, il redouble de fracas:¹⁸ on eût dit (k) vingt tambours battant à la fois; jamais le tambour-maitre n'avait si hardiment frappé une caisse. Les soldats s'élançant de nouveau et entrent dans la batterie,¹⁹ Bilboquet le premier, criant à tue-tête (l) aux Russes—

"Les morceaux en sont bons, les voici;²⁰ attendez, attendez!"

COLLOQUIAL EXERCISE.

- | | |
|--|---|
| 1. Que remarquait-on néanmoins dans la compagnie? | 8. Comment apostropha-t-il le tambour-maitre? |
| 2. Quel ordre le capitaine avait-il donné au tambour-maitre? | 9. Que voulait faire le tambour-maitre? |
| 3. Que fit celui-ci après avoir reçu cet ordre? | 10. Où était alors notre héros? |
| 4. Où était Bilboquet pendant ce temps-là? | 11. Que firent les soldats en voyant son intrépidité? |
| 5. Que faisait-il? | 12. Quel effet produisit la décharge des six pièces de canon? |
| 6. Le tambour-maitre paraissait-il disposé à obéir au troisième ordre? | 13. Que virent les soldats quand la fumée fut dissipée? |
| 7. Que fit alors le petit tambour? | 14. Qu'entendaient-ils malgré le bruit du canon? |
| | 15. Que firent alors nos voltigeurs? |

- | | |
|--|--|
| 16. Quel fut l'effet d'une seconde décharge? | 18. Que fit Bilboquet à la vue du carnage? |
| 17. Combien d'hommes restait-il? | 19. Que firent alors les soldats? |
| | 20. Que cria alors le petit tambour? |

NOTES.

- | | |
|---|--|
| (a) Il entra, there was. | (g) From vouloir. |
| (b) À cheval, seated across. | (h) Enragé, madman. |
| (c) Venait d'être, had just been. | (i) From voir. |
| (d) From paraître. | (j) From venir. |
| (e) Sous le nez, close to the face; lit., under the nose. | (k) On eût dit, one would have thought that; lit., said. |
| (f) From venir. | (l) À tue-tête, with all his might. |

SECTION IV.

Pendant ce temps, Napoléon monté sur un tertre, regardait exécuter cette prise héroïque.¹ À chaque décharge, il tressaillait sur son cheval isabelle; puis, quand les soldats entrèrent dans la batterie, il baissa sa lorgnette en disant (a) tout bas: "Braves gens!"²

Et dix mille hommes de la garde, qui étaient derrière lui, se mirent (b) à battre des mains et à applaudir³ en criant— "Bravo, nos voltigeurs! Et ils s'y connaissent (c), je vous assure."

Aussitôt, sur l'ordre de Napoléon, un aide-de-camp courut (d) jusqu'à la batterie⁴ et revint (e) au galop.

"Combien sont-ils arrivés?"⁵ dit l'empereur.

"Quarante," répondit l'aide-de-camp.

"Quarante croix demain,"⁶ dit l'empereur en se retournant vers son major-général.

Véritablement, le lendemain, tout le régiment forma un grand cercle autour des restes des deux compagnies de voltigeurs,⁷ et on appela successivement le nom des quarante braves qui avaient pris (f) la batterie,⁸ et l'on remit (g) à chacun d'eux la croix de la Légion-d'Honneur.⁹ La cérémonie était finie, et tout le monde allait se retirer, lorsqu'une voix sortit du rang et fit entendre (h) ces mots,¹⁰ prononcés avec un singulier accent (i) de surprise—

"Et moi! moi! je n'ai donc rien?"

Le général qui distribuait les croix, se retourna et vit planté (j) devant lui notre camarade Bilboquet, les joues rouges et l'œil presque en larmes.¹¹

"Toi?" lui dit-il, "que demandes-tu?"

"Mais, mon général, j'en étais" (k) dit Bilboquet presque en colère;¹² "c'est moi qui battais (l) la charge en avant, c'est moi qui suis entré le premier."

"Que veux-tu (m), mon garçon? on t'a oublié," répondit le général; "d'ailleurs, ajouta-t-il en considérant que c'était un enfant, tu es encore bien jeune, on te la donnera quand tu auras de la barbe au menton;¹³ en attendant, (n) voilà de quoi te consoler."

En disant (o) ces paroles, le général tendit une pièce de vingt francs¹⁴ au pauvre Bilboquet, qui la regarda sans penser à la prendre.¹⁵ Il s'était fait (p) un grand silence autour de lui, et chacun le considérait attentivement;¹⁶ lui, demeurait immobile devant le général et de grosses larmes roulaient dans ses yeux.¹⁷ Ceux qui s'étaient le plus moqués de lui paraissaient (q) attendris,¹⁸ et peut-être allait-on élever une réclamation¹⁹ en sa faveur, lorsqu'il releva vivement la tête, comme s'il venait de prendre une grande résolution, et il dit au général—

"C'est bon, donnez toujours (r), ce sera pour une autre fois."²⁰

Et sans plus de façons, il mit la pièce dans sa poche et s'en retourna dans son rang en sifflant d'un air délibéré et satisfait.²¹

COLLOQUIAL EXERCISE.

- | | |
|---|---|
| 1. Que faisait Napoléon pendant ce temps-là? | 8. Qu'appela-t-on successivement? |
| 2. Que fit-il quand les soldats entrèrent dans la batterie? | 9. Que donna-t-on à ces braves gens? |
| 3. Que firent les soldats de sa garde? | 10. Qu'arriva-t-il lorsque la cérémonie fut finie? |
| 4. Quel ordre Napoléon donna-t-il à l'aide-de-camp? | 11. Que vit alors le général? |
| 5. Que dit-il à l'aide-de-camp à son retour? | 12. Que répondit le petit tambour à la question du général? |
| 6. Quel ordre donna-t-il au général? | 13. Que dit le général, quand il eut remarqué que Bilboquet n'était qu'un enfant? |
| 7. Que fit le régiment le lendemain? | 14. Que lui donna-t-il? |

- | | |
|---|--|
| 15. Bilboquet prit-il la pièce? | 19. Qu'allait-on faire en sa faveur? |
| 16. Regardait-on le petit tambour? | 20. Que dit-il enfin au général? |
| 17. Que faisait-il alors? | 21. Que fit-il après avoir mis l'argent dans sa poche? |
| 18. Les voltigeurs se moquaient-ils de lui? | |

NOTES.

- | | |
|--|--|
| (a) From dire. | (k) J'en étais, I was one of them, of the number. |
| (b) Se mirent, commenced. | (l) From battre. |
| (c) Ils s'y connaissent, they were good judges of such things. | (m) Que veux-tu, how can I help it, what can I do? |
| (d) From courir. | (n) En attendant, meanwhile. |
| (e) From revenir. | (o) From dire. |
| (f) From prendre. | (p) Il s'était fait, there was. |
| (g) Remit, presented. | (q) From paraître. |
| (h) Fit entendre, uttered. | (r) Toujours, notwithstanding; lit., always. |
| (i) Accent, tone. | |
| (j) Planté, standing; lit., planted, posted. | |

KEY TO EXERCISES TO LESSONS IN FRENCH.

EXERCISE 73 (Vol. I., page 294).

1. Can you do without ink? 2. We can do without it, we have nothing to write. 3. Do you use your pen? 4. I am not using it; do you want it? 5. Will you not draw near the fire? 6. I am much obliged to you, I am not cold. 7. Why do those young ladies go from the window? 8. They leave it because it is too cold there. 9. Do not those children apply to you? 10. They apply to me and to my brother. 11. At what hour do you awake in the morning? 12. I awake generally at a quarter to six. 13. Do you rise as soon as you awake? 14. I rise as soon as I awake. 15. What books do you use? 16. I use mine and yours. 17. Do you not use your brother's? 18. I use them also. 19. Are the pens which you use good? 20. Why does your friend draw back from the fire? 21. He draws back because he is too warm. 22. Why does your servant draw near it? 23. He draws near it to warm himself. 24. Are you becoming weary of being here? 25. I am not weary of it.

EXERCISE 74 (Vol. I., page 294).

1. Voulez-vous me prêter votre canif? 2. Je ne puis m'en passer, j'en ai besoin pour tailler ma plume. 3. Voulez-vous vous servir de mon livre? (Avez-vous besoin de mon livre?) 4. J'ai besoin de m'en servir, voulez-vous me le prêter? 5. De quel couteau M. votre frère se sert-il? 6. Il se sert du couteau de mon père et de la fourchette de mon frère. 7. Ne voulez-vous pas vous approcher du feu? 8. Nous vous sommes bien obligés, nous avons chaud. 9. Cette demoiselle a-t-elle assez chaud? 10. Elle a très froid. 11. Dites-lui de s'approcher du feu. 12. Pourquoi vous éloignez-vous du feu? 13. Nous avons trop chaud. 14. M. votre frère s'éloigne-t-il de la fenêtre? 15. Il s'éloigne de la fenêtre parce qu'il a froid. 16. A qui ce Monsieur s'adresse-t-il? 17. Il s'adresse à moi et à mon frère. 18. Pourquoi ne s'adresse-t-il pas à moi? 19. Parce qu'il a honte de vous parler. 20. Vous éveille-t-il de bonne heure, tous les matins? 21. Je m'éveille de bonne heure, quand je me couche de bonne heure. 22. Pourquoi vous endormez-vous? 23. Je m'endors parce que je suis fatigué. 24. Avez-vous peur de vous approcher de votre père? 25. Je n'ai pas peur de m'approcher de lui. 26. Pouvez-vous vous passer de nous? 27. Nous ne pouvons nous passer de vous, mais nous pouvons nous passer de votre frère. 28. Avez-vous besoin du cheral de mon frère? 29. Non, Monsieur, nous pouvons nous en passer. 30. Avez-vous l'intention de vous passer d'argent? 31. Vous savez très bien que nous ne pouvons nous en passer.

EXERCISE 75 (Vol. I., page 295).

1. Are you soon going away? 2. I am going away next week. 3. Why do you go away? 4. Because I do not like being here. 5. Do you like being with your aunt better than being here? 6. I like it better. 7. Are you not wrong to go away so soon? 8. I am right to go away. 9. Do you not rejoice at the misfortunes of others? 10. We do not at all rejoice at them. 11. Does that man become angry with the gardener? 12. He becomes angry with him, because he will not make haste. 13. Does he get angry very often? 14. He gets angry every moment, he gets angry at nothing. 15. Do you never make haste? 16. I always make haste when I have something to do. 17. Do you not delight in running and playing? 18. I delight in playing, and my brother delights in reading. 19. Do you rejoice at the arrival of the Turkish ambassador? 20. I rejoice at it. 21. Do you not like being in America? 22. I like being here much better than being in France. 23. Does not your scholar like being at your house? 24. He likes being with me, but he wishes to return to his father's. 25. Make haste, it is already noon.

EXERCISE 76 (Vol. I., page 295).

1. A quelle heure votre ami s'en va-t-il? 2. Il s'en va tous les matins à neuf heures. 3. Vous en allez-vous avec lui? 4. Je m'en vais avec lui, quand j'ai le temps. 5. Voulez-vous vous dépêcher de

finir votre lettre. 6. Je me dépêche de la finir. 7. Le jardinier se fâche-t-il contre son frère? 8. Il se fâche contre lui, quand il ne se dépêche pas. 9. Dépêchez-vous, mon ami, il est dix heures. 10. Pourquoi ne vous dépêchez-vous pas? 11. Je me plais à jouer, mais je ne me plais pas à étudier. 12. Vous plaisez-vous chez moi? 13. Je m'y plais. 14. Vous réjouissez-vous de l'arrivée de votre mère? 15. Je m'en réjouis. 16. Votre frère n'a-t-il pas tort de s'en aller si tôt? 17. Il a raison de s'en aller, il a beaucoup à faire à la maison. 18. Vous réjouissez-vous des malheurs d'autrui? 19. Je ne m'en réjouis pas. 20. Je me réjouis de votre succès. 21. M. votre frère ne s'approche-t-il pas du feu? 22. Il s'éloigne du feu, il a trop chaud. 23. Cette demoiselle se fâche-t-elle contre vous? 24. Elle se fâche d'un rien (or de rien). 25. Vous plaisez-vous à Paris? 26. Je m'y plais. 27. Pouvez-vous vous passer de moi aujourd'hui? 28. Nous ne pouvons nous passer de vous, — dépêchez-vous de finir votre ouvrage.

MECHANICS.—I.

FORCE: ITS DIRECTION, MAGNITUDE, AND APPLICATION.

THE aim of these Lessons is to make evident to ordinary intelligent persons, who will take a little trouble, the principles of Mechanics—to treat that subject in a popular way, yet so that the reader may form accurate notions about it, and be enabled to apply it to practice in solving common problems by calculation. We have much to do, but all depends on the way of doing it. Study simultaneously with these lessons those upon Arithmetic; for, as we proceed, a knowledge of the four Common Rules of Arithmetic and of Proportion will be found essential. Any other mathematics you may require, I shall teach you as we go along, but the amount will be small. Observe: accurate mechanical conceptions, and the power of solving mechanical problems by construction by rule and compass or calculation, are the objects we aim at. First, then, let us ascertain what our science treats of. I believe it may accurately be described as follows:—

MECHANICS is the science of force applied to a material body or bodies.

This let me fully explain. Mechanics is concerned about force—that is its great subject. But it considers it only in the consequences which follow its application to a body or bodies which must be material. A force may push through an empty point of space; but, as it can make no impression on that point, Mechanics does not consider it under such circumstances. The body to which it is applied may be of any size, even an atom of matter, sometimes termed “a material point;” and Mechanics does inquire what effect forces have on such atoms. But, in the more common problems, it is concerned about bodies of visible and tangible magnitude, such as a block of stone, a beam of timber, a girder of iron, a cannon ball, the earth itself, the moon, or the sun.

This being clearly understood and agreed on, our next question is, What is force? I answer—

FORCE is the power, or agent, whatever be its nature, by which motion is produced in a body, or a tendency to motion accompanied by strains or pressures in its parts.

For instance, a blow is given by the bat to the cricket ball, or a bolt is fired from a cannon: the blow in the one case, and the exploding gunpowder in the other, furnish forces, the effect of which is the motion of the ball or bolt. Steam enters the cylinder of an engine, and away to work goes the machinery connected with it, moving and printing this POPULAR EDUCATOR. Here again is force, the elasticity of the steam, and its effect is motion. A stone is let loose at the top of a tower, or from a balloon, and it falls to the ground: what makes it fall? The great Earth does, which, by its attraction, pulls the stone towards itself. This attraction is the force producing the stone's motion. And if any of you doubt, or feel any difficulty about this, let him take a magnet and put one of its ends near a few loose iron filings, scattered over a piece of paper, and he will see how this is possible. The filings will

move towards the magnet, and stick to it, in the very same way that the stone moves to, and sticks to, the earth until some person pulls it away by a stronger force. And so likewise does the electrified ball draw towards itself the small pieces of cork or feather we place near it. In all these cases, you see, there is, first, a body, the ball, or bolt, or stone, or iron-filing, or cork; secondly, a force applied to it; and, thirdly, motion produced.

But take now the lamp which hangs from the ceiling. It is at rest; but the earth, by its attraction, is trying to pull it down, and down it would come were we to cut the chain or rod by which it is suspended. Here, then, is force again, but it produces only tendency to motion. But observe further, that although the lamp does not move, the chain that holds it is strained by its weight. And not only is the chain strained, but so is the ceiling joist to which it is attached; and, as this joist rests its ends on the walls, this strain is transmitted to the walls in the form of pressures on them. There is thus tendency to motion, strain, and pressure produced as the effect of the force applied by the earth to the lamp, but no motion. And, if any of you feel a difficulty in believing in those strains, let him suppose, instead of the lamp, a ton weight of iron suspended from the ceiling: what will follow? The chain will snap, or the joist, or even ceiling, will give way, and down all will come on the floor. They snap or give way because they are strained beyond their strength. So, in like manner, when a train stands at rest on one of those great iron girder bridges that span our rivers, there is tendency to motion, with strains and pressures; the great Earth below pulls at the train to bring it into the water; but the bridge resists, bears the pressure of the weight on it, and is strained throughout its length besides. A more familiar instance is the struggle of two wrestlers. No one will doubt that in the contest great force is put forth by each. For a moment they are motionless, like statues; the forces are balanced, but the strain on their muscles is terrific. There is in each tendency to motion, caused by the force put forth by the other, but as yet no motion. At last one of the combatants

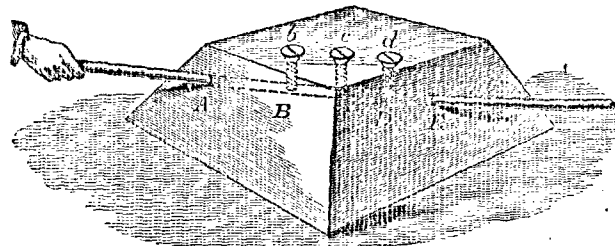


DIAGRAM ILLUSTRATING THE APPLICATION OF FORCE.

prevails; his force ends in producing motion, and his adversary falls to the ground.

These examples will, I trust, be sufficient to make clear to you the account I have given you of force, namely—that it is the agency by which motion is produced in a material body, or a tendency to motion with pressures or strains. You will now understand the reason why Mechanics is divided into two branches, Statics and Dynamics. Statics is the branch which treats of forces which balance each other, and produce only tendencies to motion with pressures and strains, and is so called from the Latin word *sto*, which means “to stand,” or “be at rest.” Forces which thus balance one another are said to be in *equilibrium*, a Latin expression which denotes the balancing of equal weights; and it is important that you should keep the expression in memory, as we shall have frequent occasion to use it. The other branch, Dynamics, treats of force or forces which do not balance one another, but produce motion, and was so named from the Greek word *δυναμις* (*du-na-mis*), power, under the mistaken notion that there was more power in force when its effect is motion, than when it produces strain. This, we have seen, is not the case; but the term “Dynamics” may, notwithstanding, continue to be used without leading to error. The two branches we may therefore define or describe as follows:—

STATICS is the branch of Mechanics in which forces are considered which equilibrate, or balance one another, producing tendencies to motion, with strains and pressures.

DYNAMICS is the branch of Mechanics in which forces are considered which produce motion.

Now it so happens that, of these branches, Statics is the simpler and easier, and more natural for the student to commence with. Questions about forces which balance each other are not so complicated as those which involve motion. The reason is, that time enters into all problems of motion, but

not generally into those of equilibrium. The speed or velocity of a cannon-ball must be considered at every varying moment of its flight; but the strains and pressures among and on the beams of the roof of a railway station are the same at all moments. Time does not affect the latter unless by wear and tear. With statics, therefore, we commence, and, of course, with the simplest class of questions, those which relate to a force or forces acting on a single point. But here I must turn back to the notion of force, and endeavour to fix it with greater accuracy in your minds. I must show you how it is said to be applied and measured to the body it moves or strains; and this will best be done under the three following heads:—

1. The Direction of a Force.
2. The Point of Application of a Force.
3. The Magnitude of a Force.

1. *The Direction of a Force.*—In Mechanics, forces are assumed to act in right lines. The assumption is made for the best of reasons—namely, that of experience. All the simpler cases of motion confirm it, and all the more complicated can be accounted for by it. A ball falls to the ground in a right line—that which points to the centre of the earth, whence the force of attraction which moves it acts. The billiard-ball moves in a right line; and the calculations of the skillful player, which are based on the supposition that it so moves, are never found to be wrong. A ship, with her sails square set and wind aft, moves in a right line; and to make it leave that line the steersman must put the helm to port or starboard, and by turning the face of the rudder against the water, cause another force to be applied to the ship across the line of its course, and at her stern, turning her round. It is true that the stone thrown obliquely into the air moves in a curved path; but in this case we know that there are two forces—not one only—acting on it, namely, the original impulse, which makes it move in a right line, and the earth's attraction, which pulls it from that line into a curved course. Moreover, all the calculations on which are based the predictions of astronomers as to the places in which the sun, moon, and planets will be on a certain day, hour, and minute, are based on this assumption, that forces act in right lines; and the predictions invariably prove true. Our first mechanical axiom may, therefore, on the ground of experience be assumed to be true—namely, that the direction in which a force acts is that of a right line. Indeed, it is not easy to conceive how it could act otherwise.

2. *The Point of Application of a Force.*—The direction of a force being disposed of, we must fix our ideas as to its point of application. The rule is, that any point on the line of its direction may be considered such; but this you must understand with a limitation, or exception, which should not be forgotten. The point of application can only be on so much of the line of direction as lies within the body. For instance, suppose a person to push with an iron rod, which he holds in his hand, at the point A (as in the diagram), against a block of iron which lies on a table. Then, clearly A is the point of application of the force with which he pushes. Let now a hole be drilled through the block in the direction of the push from A to E, into which the rod may fit closely but freely; and also other holes, downwards, B, C, D, to meet the passage A E, into which thumb-screws, b, c, d, are fitted. Let the rod now be passed through the block so as to emerge at the other side, and clamp it down firmly by the thumb-screw, b. If it be now pushed against the block with the same force as before, it is clear that the force will be arrested by the thumb-screw, b, at b, and that b will become its point of application to the body. So, in like manner, may it be applied to c and d, by tightening in succession each screw, while the others are left loose. In all these cases the force is the same, and the direction the same; but the points of application are different. But will the effects in the several cases be different? No; for the portion of the rod within the block, and extending from A to any of the points of application, performs the same part in transmitting the force from A to the point within, as the iron which was removed did when the force was first applied directly at A. The removed iron has its place filled by an equivalent of that metal in rod, and the body is virtually in its original condition. The force of the hand may still be considered applied at A, thence to be transmitted to b, or c, or d, as we please, by the portion of rod within. The second case becomes identical with the first, and the effects, therefore, must be identical in every respect; and, nothing

being changed, intensity, direction, nor effect of the force, it is clearly indifferent which point we make the point of application.

Another instance is the raising of a weight by a rope. Weight and rope together make one body; and whether the lifting power be applied by engine, by horse, or by man, whether it acts over a pulley or not, every point of the strained rope may be considered a point of application. Or let the case be that of three strings attached to a ring, and pulled in different directions by three persons. It makes no difference, in this compound body of ring and strings, whether the hold taken of the latter be long or short—all their points are points of application of their respective forces.

We thus see that, in all cases, we may assume that the point of application of a force is any point on so much of its line of direction as lies within the body. To suppose it applied to a point outside would be absurd; for, as we have shown, though a force may act or push through a point of empty space, it can make no impression on that point, either in the way of strain or motion, and therefore cannot come under the consideration of Mechanics.

3. *The Magnitude of a Force.*—To find a suitable measure of the intensity or magnitude of a force, we must also look to experience. It would be very convenient to measure forces by comparing them with weights; but this is not always practicable, and, even if it were, it would not answer all the purposes of Mechanics. I may as well, therefore, explain to you the perfect method, as that is as simple as any other. Experience teaches that a double force produces a double velocity, a treble force a treble velocity, and so on, in any body to which it is applied. But then a difficulty occurs: the same force will produce different velocities in bodies of different sizes. If it make a ball of one pound weight move at a certain rate, it will give double that speed to a half-pound ball, and half to one of two pounds. As a general rule, the greater the mass of the body, the less the speed produced. Everybody is familiar with this fact. We see, then, that if we desire to measure forces by the velocities they produce, we must try them on bodies of some fixed weight or mass. Tried on this particular mass, experience teaches that that which produces the greater velocity is the greater force. Now, the mass of matter which mechanicians choose for this purpose is that of any substance which is equal in weight to a cubic inch of distilled water. That much matter is designated the Unit of Mass, and for a reason I shall hereafter more fully explain. Imagine, then, a round ball, say of ivory, whose weight is that of a cubic inch of pure water, and suppose that several forces are in succession applied to it; the velocities they produce will be accurate measures of their intensities, or of their magnitudes.

But, then, how are the velocities to be ascertained? Clearly by the spaces the ball would move over in any given time, say the unit of time—a second—on the force being applied to it. Suppose, then, the unit ivory ball, put on a perfectly smooth floor, and then suddenly struck by a blow equal to the force you want to measure. By some means—and there are many which may be devised—manage to ascertain the distance the ball moves over in one second. That space, or length of line, will be the measure of the force; and if any number of such forces be tried in the same way and on the same ball, that which causes it to move over the greater space is the greater force, over a double space a double force, and so on.

The final result, then, is that, in considering a force in Mechanics, we must first suppose drawn within the body a line representing its direction. Then, on that line, let any point be taken for its point of application. Thirdly, on the line of direction so fixed, let as many inches be measured from the point of application as, on any scale you agree to use, represents the space the force would cause the unit ivory ball to move over in one second. Then you have a line which also in magnitude represents the force. Or in fewer words—

A FORCE is represented, both in magnitude and in direction, by a finite right line passing through its point of application.

If in the above explanations I have succeeded in giving you clear notions of the aim of Mechanics, and of the nature and effects of force, you are prepared for the consideration of a force, or forces, applied to a single point, which will be the subject of our next Lesson.

LESSONS IN ITALIAN.—I.

INTRODUCTION.

I PROPOSE to teach the grammar, structure, and vocabulary of the Italian language by a method not commonly adopted by the learned. A considerable experience in tuition has convinced me that a strict adherence to scientific forms, though all-important in the cultivation of a language, does not tend to the advantage of the learner. Writers of practical grammar err, for the most part, in studying system too much. They teach grammar as they would the pure mathematics, as if an abstract science of itself, and not as a practical guide through the idiomatic intricacies of living languages. Such instructions may be very scientific in form, but they do not follow nature: there is no due separation of that which is the foundation, or, as it were, the skeleton of a language, from those things which are the ornaments, the delicacies, the accidents, and exceptions of speech. A language should be taught as anatomy is taught. We must first thoroughly study the bones, if we would successfully trace the intricate ramifications of nerves and arteries. The learner of a foreign tongue cannot for himself judge of what is material or immaterial to his sure and rapid progress. It will be my endeavour to instruct by a colloquial and natural, rather than a grammatical and purely scientific method.

The Italian language has for a long time been regarded in this country as a fashionable branch of education. Knowledge of it has been reckoned an indispensable accomplishment of cultivated society, but rather, as it would seem to me, as a serviceable attendant at Italian picture galleries and operas, than as a guide to the philosophy of a Dante, the invention of an Ariosto, or the sagacity of a Machiavelli. The present is perhaps the first considerable attempt that has been made to popularise this noble and melodious tongue.

The Italian is the first-born of the old language of Rome, and owns a strength and beauty worthy of its noble origin. In cultivation, it is the oldest of European tongues. When Dante wrote, English, French, and German were comparatively rude dialects. To Italy the world owes the preservation and regeneration of learning and the arts; and its fine soil, the fertile mother of great spirits of old, has produced to the latest times men who have enriched every intellectual pursuit alike by their genius and learning. The language in which they expressed that infinite variety of thought and sentiment, contains a literature, the rich mine of which is in foreign countries only known to solitary and toilsome explorers. The time may not be distant when the increased intercommunication of nations, and the progress of popular education, will lay these rich treasures open to the many.

For its own intrinsic merits, however, as a language, Italian deserves to be studied by every one who would enjoy the pleasures of style, inexhaustible in variety: the energy of Dante, the graphic power of Boccaccio, the lyrical grace of Petrarca, the refinement of Ariosto, the ornament of Tasso, the satire of Berni and Aretino, the historical dignity of Guicciardini and Botta, the point and perspicuity of Machiavelli, the hilarity of Casti, the music of Metastasio, and the Roman manliness of Alfieri. And they who would cultivate language for its excellence must seek that of Italy for the ideal beauty of expression.

My method will be a natural, a simple, and, I trust, an easy one. I shall discard, as much as possible, all the conventional terms of grammar. I shall not travel by the old beaten pathway through the parts of speech. My grammatical progress will imitate the action of the mind in the formation of a sentence, with a due regard to peculiarities of idiom. As a child first learns the name of a thing, I begin with the noun, as soon as I have clearly explained the principles of pronunciation; and as the child demonstrates its progress in thinking by connecting an action or suffering with the object named, I shall proceed at once to the verbs. The verb is the life of a language, and he who knows the verbs thoroughly has mastered the chief difficulty of his task. The remaining kinds of words will be taught and discussed in the same natural order.

These lessons will contain, if I may so speak, two grammars. Presuming that I may find two classes of readers—one anxious for knowledge by the most easy and rapid manner, the other with more preparation, inclination, and leisure for study—I have so shaped my labour as to combine in a form sufficiently marked, though not separated, an elementary grammar which

shall give the before-mentioned indispensable foundation and skeleton; and a grammatical treatise which shall, with philosophical reasons, satisfactorily explain the ornaments, the delicacies, the accidents, and exceptions of the language.

As I have said, I shall not divide my grammar into parts of speech, but into paragraphs. In the paragraphs I shall distinctly mark the line of separation between the elementary grammar and the grammatical treatise by the title of "ADDITIONAL REMARKS." The student who only desires to learn the language sufficiently to enable him to read, speak, and write with tolerable accuracy, need only attend to the *numbered paragraphs*; but he who would learn the language thoroughly, must follow me closely and carefully in all I may find occasion to say in the *additional remarks*.

Each paragraph will be complete in itself—a decided step in the knowledge of the language. Every principle of the language will be clearly illustrated by examples, including vocabularies and exercises.

I have now only to ask the earnest and patient attention of my pupil readers.

I.—ON THE PRONUNCIATION OF ITALIAN.

I shall teach the pronunciation of the Italian language in more detail than is generally pursued in English tuition. The profit to be derived from the study of any living language is much less if we are unable to pronounce it correctly. We can make little practical use of our theoretical acquirements, if in communication with those to whom this language is the mother tongue; we can neither make ourselves understood when we speak, nor understand when we are spoken to. And besides, no man, though he may gather the sense, can relish or even comprehend the beauties or delicacies of great poets, and prose writers, too, in any language, and more especially in that of Italy, without an accurate knowledge of the sounds. In reading such poets as Ariosto or Tasso, the pleasure does not consist altogether in appreciating the thoughts, or even shades of thoughts, but in the faculty to enjoy that divine harmony to which they have attained the language. One may relish the beauty of the rose, but if he be deprived of the sense of smell, he can admire only a lifeless beauty. Such students of the Italian poets, to use a more homely figure, may read their poetry with the satisfaction with which one might admire a Turkey carpet, who has seen the reverse side only. There is no insuperable or even very considerable difficulty in mastering Italian pronunciation; but a thoughtful attention to some leading principles, and a student-like diligence, are conditions essential to success. My thoughtful and industrious pupils will very soon find that a prolixity in this the very outset of my labours which might seem trifling, is really most important—one of the fundamental parts of the language.

I am aware that I am writing for the most part for adult readers; but let them for a little space forget the dignity of manhood; for every learner of a language, be he as old as Cato was when he learnt Greek, should be regarded as a child learning to express his thoughts. Indeed, the more he is taught a foreign tongue as the child his mother's speech, the better for him.

A living language can never be accurately and completely expressed by signs. They who profess the contrary only mislead the uninformed. But a tolerable approach to accuracy in fixing pronunciation may be made by letter-signs representing analogous sounds familiar to the ear in one's own language. If one has made himself so familiar with the imitated sounds, as to have acquired a considerable vocal command of the leading ones, he may very soon accurately and permanently acquire them, by a few brief communications with an educated native.

Perhaps the most useful beginning I can make, is to point out the leading errors which Englishmen commit in pronouncing Italian. The reason of this is, that men are apt to transfer involuntarily the peculiarities of their own language to that which they are studying. The first effort, therefore, in learning to pronounce Italian, should be to forget your native peculiarities. In the mastery of the pronunciation of the continental languages, and particularly of Italian, the Englishman's great difficulty is in the vowels.

The Englishman, perhaps from childhood, has heard no vowel sounds but those of his own island—his four sounds of *a*, his four sounds of *o*, his three sounds of *u*, his two sounds of *e*, and

his two sounds of *i*—sounds little swayed by rule, and changing continually. He begins Italian, but carrying to the study the complex vocal habit of his language, it must be some time before he can comprehend and practise the simplicity and permanence of the sound of one Italian *a*, one Italian *i*, one Italian *u*, two Italian *e*'s, and two Italian *o*'s. He therefore pronounces no vowel purely, and wherever he may move in Italy, his insular nativity will be instantly recognised by the *facchino* of any village inn, from his inveterate habit of giving to the Italian *a* that most comical of sounds to a Tuscan ear, of a *in hat and fat*.

Another radical error committed by Englishmen in pronouncing Italian, arises from two opposite principles, which may be said to be the fundamental rules of the accentuation of the languages. In English, every word has its leading, marked, or strongly accented syllable—generally speaking, the root of the word; and it follows that while this syllable is distinctly marked by the voice, the subordinate unaccented syllables fade away in the utterance into an airy nothingness that can hardly be described. It is quite different with Italian. It has its accented syllables just as in English, but the accent on the one does not destroy the vocal enunciation of the others. On the contrary, full and substantial justice must be done to every syllable, each being clearly sounded, full and roundly with the vowels, and in a resonant or vibrating tone with the consonants. The contrast may be observed in the pronunciation of any of the many words of a kindred sound in both languages derived from the same classic stock. Take the following:—

English.	Italian.
Difficulty.	Diffi-col-tà.
Voluntarily.	Vo-lon-ta-ria-men-te.
Detestably.	De-te-sta-bil-men-te.
Generously.	Ge-ne-ro-sa-men-te.
Indifferently.	In-dif-fe-ren-te-men-te.
Repetition.	Re-pe-ti-zi-o-ne.

This peculiarity of the English language, it may be remarked, is the great obstacle which every English poet has encountered in the effort to naturalise the classic measures of antiquity. Contrasted with the open limpid vocalisation of Italy, the pronunciation of the English is to an Italian so obscure or indistinct, as very frequently not to be even understood. It might be presumed that in a word so sonorous as *detestabilmente* or *volontariamente* it would be impossible to miss the true sounds, yet an Englishman will, generally speaking, so slur over what he would from the analogy of his own language conceive to be the subordinate parts of the word, as to be often quite unintelligible to an Italian.

A third and radical difference between the two languages, as regards the principles of pronunciation, proceeds from what may be termed the vocal mechanism or the physical principles of enunciation. Shortly stated, the physical difference is this: in England, they speak from the mouth; in Italy, from the chest. The Englishman whispers his words through the palate, tongue, teeth, or lips; the Italian throws them out with the vigour of his lungs. When, therefore, the Englishman attempts the pronunciation of Italian after his accustomed mode, he confines the open sounds of Italy to the limited mechanism of his hissing or lisping articulation above the throat, and turns Italian melody into harmonious discord, now a croak, now a hiss.

These are the radical differences and difficulties which my readers must strive to overcome. This is only to be accomplished by a constant recollection of these points of difference in connection with the rules I am about to state and illustrate, and by reading aloud, with a clear and distinct voice uttered from the chest, every Italian word which I may have occasion to give in the course of the grammar.

HISTORIC SKETCHES.—XXVII.

HOW IRELAND BECAME PART OF GREAT BRITAIN.

PART I.

A GLANCE at the map of the United Kingdom will serve to show that England being inhabited by a powerful people, numerically superior to the peoples both of Scotland and Ireland, those two countries must necessarily be in union with her. Neither of them could rest in security in the neighbourhood of so strong a state; both would in turn be

liable to be objected to, as the lamb was by the wolf in the fable; and unless they could secure efficient foreign alliances, they must, sooner or later, fall a prey, as the lamb also did. For it would be manifestly intolerable for the strong state to have possible enemies so near, opening a way at any time into the very heart of her dominion, presenting a ready means of injury available by the first enemy which chose to bid for the friendship of either Scotland or Ireland; and it could not be but that the strong state should perpetually strive to remove, by some means or other, the possibility of harm from such a source. Union would seem therefore to be suggested by the best interests of all concerned. It was also, politically considered, a necessity: a matter in which the time of its coming about was the only doubtful point.

In another paper ("How England and Scotland Became One," Historic Sketches, No. XVIII.), it was shown how the necessity for union presented itself to the mind of him who has been called "the greatest of the Plantagenets," "the English Justinian," Edward I. There, too, was shown, especially in regard to Scotland, the manner in which the English king strove to supply his necessity: how, acting according to his instincts, he tried to dragoon the Scots into union; how he for a while succeeded, and how finally his efforts were frustrated, and he had nothing under the sun for his warlike labour. His state policy was a sound one, but his means for carrying it out were unwisely chosen, and his proud spirit scorned to apply itself to any other. He would be Caesar or nothing, and in the course of his time he was both, as regarded the rulership of Scotland. How the union with Scotland was ultimately managed was also pointed out in the same paper. Let us now turn to the case of the sister island, and, with a view to see how that came into the union, trace the history of the various events that led up to the desired consummation.

To say that Ireland fell to England by conquest is neither wholly true nor wholly false. It is wholly false to say that it was conquered in the sense that Edward I. tried to conquer Scotland—conquered, that is, as a whole, the entire nation being united under one head for the purpose of resisting a common invader. It is not only doubtful whether, had the Irish been united, the Anglo-Normans who went over would ever have possessed more ground in the country than was needed to cover their bones, but it is almost certain that the subjugation of the island would never have taken place; assuredly it would not with the force which actually went over. Of course, after the precedent set at Hastings, where the fate of England was decided in one pitched battle, and in view of the fact that a mob, however numerous, can avail nothing against the attack of disciplined troops, it is perhaps presumptuous to say so much; but we have only to point to the case of Scotland for justification, and to see how there the whole strength of England failed to hold in bondage a united, freedom-loving people, irregular and undisciplined though they were, in comparison with the followers of the first soldier of his day. Ireland was not conquered as a whole, for it never resisted as a whole—never acknowledged for the purposes of the common weal one supreme head or "dictator whom all men should obey." It is not, therefore, absolutely true to say that it was conquered; neither is it absolutely false. It fell like the house that was built upon the sand, because it had no foundation and was divided against itself. Bit by bit it was subjugated by force of arms, and according to a system of warfare which aimed at preventing a repetition of resistance by means of extirpation—a system which required the constant presence of a strong military force in the conquered districts, and which provoked from time to time those outbursts of national and party anger which the system has periodically put down with bloodshed and violence. At no one period in her history has Ireland ever been united as Scotland was when she successfully resisted the invader; at no one time has the sister island been animated by the Scottish love of freedom, and dogged determination never to acknowledge a foreign yoke; and certainly, at the time of the first attempt that was made upon her independence, Ireland was split up into rival factions as bitter and hostile to one another as the worst common enemy could desire.

The restless spirit that dwelt in the breast of every Norman

very early drove the Norman masters of England to seek fresh adventures, fresh conquests. Before their power in England was consolidated, before they had had time to push their authority into the heart of Scotland, they looked greedily across the water which divided their newly-gotten kingdom from the kingdoms of Ireland, and they resolved to win in them a settlement as absolute and abiding as that they had obtained in England. Lust of power, of acquisition, rather than any far-sighted views of statesmanship, prompted the first invaders of Ireland to undertake their work, and they entered upon it in a spirit wholly in accordance with the motives that actuated them.

The conquest of Ireland was on this wise:—It had been agreed in 1161, after many trials of strength between the several Irish princes, that Murtogh O'Lochlin, King of Ulster, should be recognised as supreme in the island. He was nominally what was then called a suzerain, as distinguished from a sovereign; that is to say, he was feudal lord over his brethren by their own consent—a "first among equals," but not absolute dominator, except in his own kingdom of Ulster. The princes who consented to this arrangement were four in number—the kings of Munster, Connaught, Leinster, and Meath, each of whom had vassals under them more or less troublesome, who made their sovereignty as permissive a dignity as the four kings made the dignity of Murtogh O'Lochlin. Of course, a throne resting on such explosive materials must have been but an anxious place, not to say an unsafe one. The broils which had only been temporarily suppressed through the effect of exhaustion in the combatants, broke out again as soon as strength had been renewed, and all was commotion in the kingdom of Erin. Fighting for fighting's sake was sufficient inducement, when all other causes failed, to make the princes take up arms; and the only wonder is how the people subsisted at all in a country which was ravaged with fire and sword all over on an average once a year. Domestic peace within the limits of the lesser kingdoms themselves was a thing unknown; the vassals were too nearly equal for jealousy not to show itself in action; and combined, they were more than a match for their kings. This was proved in the case of Murtogh O'Lochlin himself, who having waged war on one of his vassals in a perfectly barbarous way, having put out his eyes, and slain his most intimate friends in cold blood, roused by his acts so great a resistance on the part of his other subjects, that he was overthrown and killed in a battle, on the issue of which he had staked his fortune.

On his death in 1168, the nominal sovereignty of Erin passed to Roderic O'Connor, King of Connaught, a savage, whose first act, on coming to his father's throne in Connaught, was to put out the eyes of his two brothers, lest they should be troublesome as competitors. He is also famous for having killed with his own hand an enemy whom he had had loaded with chains, and who was defenceless through his fetters at the time the king struck him. Such a man was not likely to have a peaceable time of it, and his reign proved to be such a turmoil and confusion as to tempt the intervention of a foreign foe.

Dermot Mac-Murcad, King of Leinster, a bloodthirsty and licentious barbarian, had, during the reign of the late suzerain, conducted himself so infamously as to excite universal hatred and disgust against him, except on the part of the suzerains who were his dear friends and intimates. He had carried on an adulterous intercourse with the wife of a neighbouring and friendly prince, Tiernan O'Ruarc, the Lord of Breffny, in Connaught, an act which caused the direst commotion, and was the beginning of sorrows for all Ireland; for it became as fruitful a source of quarrel as the abduction of Helen from her husband Menelaus, and was the root of bitterness which sprang up and finally choked the fair flower of Irish independence. So long as O'Lochlin was on the throne this bad man had a friend, and gloried in his shame shamelessly; but with Roderic O'Connor, though he was what he was, came a very different ruler. O'Connor was friendly to the lord of Breffny, and espoused his cause immediately on coming to the throne. Under his auspices a rebellion was fomented in Dermot's own kingdom of Leinster. Tiernan O'Ruarc took the field with a large force raised in his own dominions, and recruited by numerous bands of men whom Dermot's brutality and tyranny had embittered against him. In a short time Dermot was driven to his last covert, and was then obliged to fly for succour to the King of England.

Now, at the time he did so, Henry II. was in Normandy, wholly absorbed in his great struggle between Church and State, represented by Thomas à Becket and himself; and it is reasonable to suppose that he did not at the moment care very much for the visitor who came to him with such importunate requests for help in a matter where the King of England's interests were not concerned. The application of the Irish prince, however, was not to be rejected summarily; the sound of it recalled to the mind of the great statesman who then sat on the English throne a plan he had long ago thought over, but, for want of opportunity, had lain aside. Eleven years before—that is to say, in 1155—he had obtained from Pope Adrian IV. (the only Englishman who ever sat in the chair of St. Peter) a Papal bull, granting him the lordship of Ireland with full possession of the country, the Pope claiming, and Henry for the nonce admitting, a right in the Pope to dispose of the whole of Christendom as lord paramount. At the time of the grant it had not suited Henry to take the matter in hand; he had other irons in the fire, and even now it was highly inconvenient to have to stir hurriedly in it. Still, a wandering Irish prince driven from his home, and ready to agree to any conditions so long as he was restored and his enemies were punished, was not a sight that presented itself every day; and the astute mind of Henry saw at once the advisability of securing a pretext for his interference, which he would do under guise of helping a neighbouring potentate to his own. Once in Ireland—if with a decent excuse all the better—his plan was never to loosen his hold on it; to make it his either by playing off one petty prince against another, and making the winner recognise him for lord, or else, if needs must, though he did not want the trouble, by regular conquest of the island.

Unable to quit Aquitaine, where Dermot found him, and where certain disputes with the barons, together with the trouble respecting Becket, detained him, Henry gave the Irish prince letters recommendatory to the English nobles, and issued this proclamation in his behalf:—"Henry, King of England, Duke of Normandy and Aquitaine, and Earl of Anjou, to all his liegemen—English, Norman, Welsh, and Scotch—and to all the nations under his dominion, sends greeting. As soon as the present letters shall come to your hands, know that Dermot, Prince of Leinster, has been received into the bosom of our grace and benevolence. Wherefore whosoever, within the ample extent of our territories, shall be willing to lend aid towards the restoration of this prince, as our faithful and liege subject, let such person know that we do hereby grant to him, for such purpose, our licence and favour."

Armed with this proclamation, Dermot came over to England and hastened to Bristol, where he expected to find those who would lend a willing hand to his enterprise, thus backed by the king; but few of the English nobles had ever heard of him until the present moment, and fewer still were inclined to risk anything in a cause where the question was between barbarism on both sides, and where the issue seemed to promise little profit to assistants. No one who had anything to lose, or who had anything better with which to occupy himself, would listen to the Irish prince, who was driven, therefore, to apply to men of desperate fortunes; and such men there were then as now, and as there always will be, ready for anything which holds out the slightest hope of mending their broken condition. Such a man was Richard de Clare, Earl of Pembroke, commonly known in history as Strongbow. Dermot promised to give him his daughter Eva in marriage, and to secure him the succession, after himself, to the throne of Leinster, on condition of his bringing over an efficient force to Ireland in the following spring. Strongbow assented, and Dermot was fortunate enough to secure, in anticipation of his coming, the services of Maurice Fitz-Gerald and Robert Fitz-Stephen, brothers, and adventurers by birth and profession. These agreed to come over as early in the spring as they could; and Dermot having made his preparations, went secretly to Ireland, and remained concealed there.

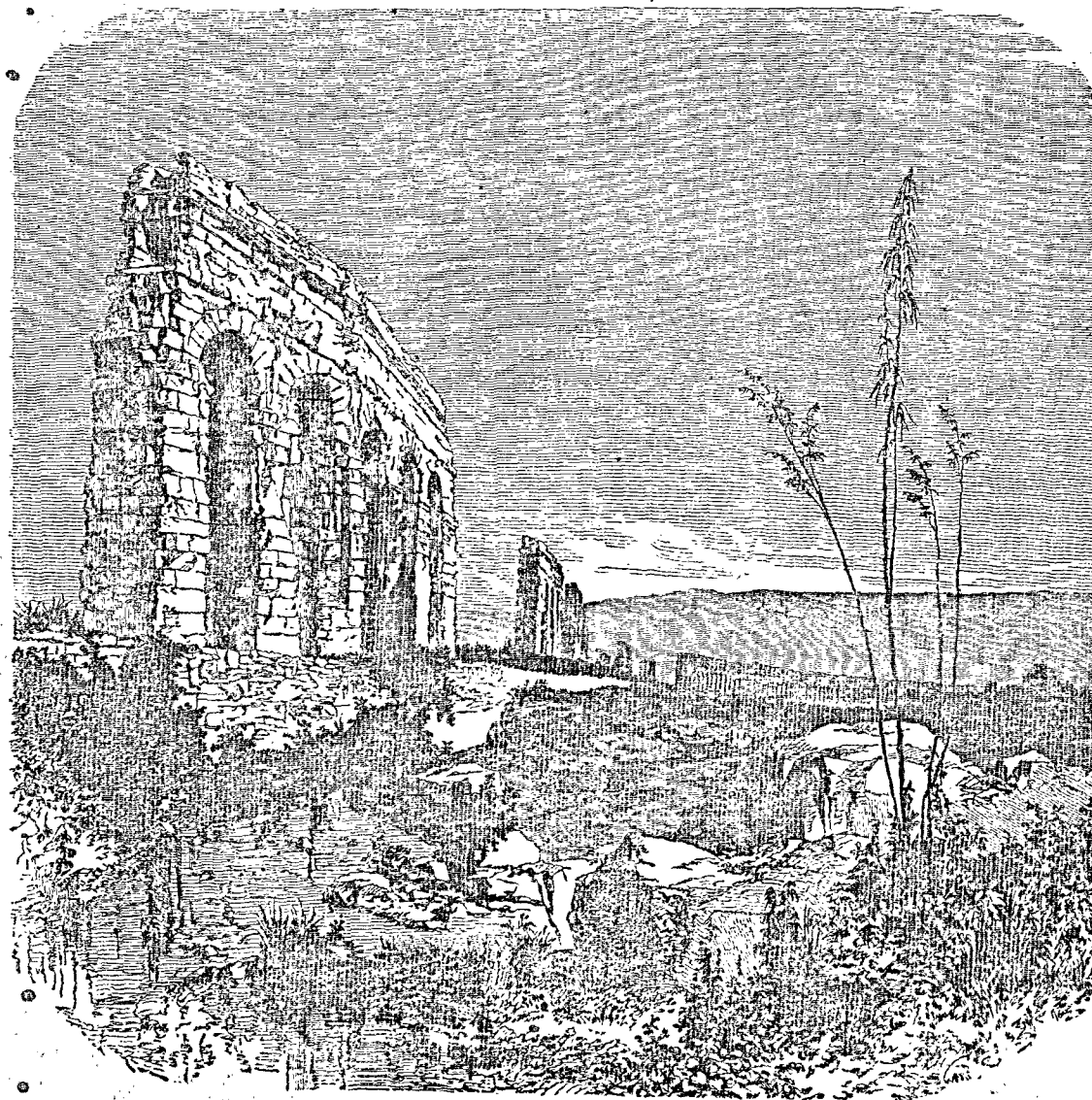
A foolish outburst of his, made before his allies could join him, nearly proved to be his ruin, and brought his old enemy, Tiernan O'Ruarc, and Roderic O'Connor, titular monarch of Erin, down upon him. He lay at their mercy, which he experienced on condition of renouncing for ever his rights in Leinster, except to a small territory not more than sufficient to support the dignity of a lesser baron. He accepted the condition, purposing only to gain time till his English friends should be ready to join him.

LESSONS IN ARCHITECTURE.—X.

ARCHITRAVES, ARCHES, AND VAULTED ROOFS.

In our last lesson we attributed the application, if not the invention, of the arch to the Romans, and showed how this ingenious people employed it in all their great and remarkable edifices. According to Frontinus, who was appointed the curator or superintendent of public works by the Emperor Nerva, Rome

miles from the city, in the neighbourhood of Palestrina, made a circuit of nearly a mile, and then passing through a deep subterranean drain, discharged the main body of its water into the *Campus Martius*, or field of Mars, at Rome, where the assemblies of the people were held for elections, etc. There are no remains of this aqueduct existing at the present time. The next was the *Anio Vetus* or old Anio aqueduct, constructed about 273 B.C., which received this name because it brought the



THE RUINS OF THE ROMAN AQUEDUCT, ANIO NOVUS.

was supplied by water by nine great aqueducts; to these he added five more, and the number was increased by succeeding emperors to twenty altogether. The arches required in the construction of these aqueducts may be more easily conceived than described. The most remarkable of them may be here noticed.

The first was the *Aqua Appia*, or Appian water, so called because it was constructed by the censor Appian Claudius, in 442 A.U.C., that is in the 442nd year from the building of the city (*Ab Urbe Condita*), this being the year 311 B.C., or before the birth of Christ. This aqueduct commenced about seven

waters of the Anio, a tributary of the Tiber, into the city of Rome. The commencement of this aqueduct was at the distance of 30 miles from the city, and it consisted chiefly of a winding drain which was carried through an extent of 43 miles. The third was the *Aqua Marcia*, so called because it owed its erection to Quintus Marcius Rex, about 145 B.C., which originated in a spring about 60 miles distant from Rome, made a circuit of three miles, and then, forming a vault of 16 feet in diameter, ran 60 miles along a series of arcades at the elevation of 70 feet. At certain intervals of this aqueduct vents were formed for disgorge the collected air, and it was occasion-

ally interrupted by deep cisterns in which the water was allowed to settle and deposit its sediment. This water, so carefully managed, was remarkable for its coolness and salubrity, and its clear green colour. The *Aqua Tepula*, built 126 B.C., and *Aqua Julia*, constructed by Agrippa, 34 B.C., were aqueducts which brought water to the city by two conduits passing one above and one under the channel of the same aqueduct just described. Sixthly, came the *Aqua Virgo*, also constructed by Agrippa, who lived under the Emperor Augustus, who laboured to improve and beautify Rome, and who, according to Pliny, constructed in one year 70 pools, 105 fountains, and 130 reservoirs. This aqueduct commenced in a very copious spring, which rose in the midst of a marsh about 14 miles from the city; it ran circuitously a distance of about 18 miles, and in its course passed through a tunnel four-fifths of a mile long. The *Aqua Alsetina*, now called the *Aqua Paola*, was built by Augustus to bring water to the Naumachia, a sheet of water formed by the same emperor for the representation of sea-fights. The eighth aqueduct was the *Aqua Claudia*, which was begun by Caligula and finished by Claudius, 51 A.D. It took its rise 30 miles from Rome, forming a subterranean stream 36½ miles long, and running 10½ miles along the surface of the ground. This aqueduct was vaulted for the space of 3 miles, and supported on arcades for the space of 7 miles, being carried along such a high level as to be able to supply all the hills of ancient Rome. It was built of hewn stone, and the ruins furnished the materials for the *Aqua Felice*, a modern water-course built by Pope Sixtus V. The *Anio Novus* or New Anio, and its branch the *Aqua Trajana*, were built at a later date, with the *Aqua Antoniana* and some others. The *Anio Novus* was 62 miles long, and with the *Aqua Claudia* doubled the quantity of water hitherto supplied to Rome by the older aqueducts.

It was in the reign of the Emperor Augustus, who greatly extended the aqueducts of Rome, that the practice of tunnelling was commenced; and other emperors, who followed him, carried out the same important department of engineering. The Emperor Trajan particularly exerted himself in the improvement of these aqueducts. Such works were executed in a bold and original manner; nothing could damp the skill and enterprise of the Roman architects. They drained lakes, excavated mines in the mountains, and elevated valleys by rows of accumulated arcades. The water of the aqueducts was kept cool by covering it with vaults; and they were often so spacious that, according to Procopius, they admitted of a man riding through them on horseback. The supply of water in Rome from these wonderful erections was indeed so abundant, that Strabo says whole rivers of water flowed through the streets of Rome. Pliny justly considered these aqueducts as the wonder of the world, for their grandeur, extent, and utility; and it seems very surprising to us, when we contemplate the high pitch to which civil engineering and architecture have risen among ourselves, that we have no such splendid aqueducts to supply our modern cities, such as London, with water. According to the enumeration of Frontinus, the nine earlier aqueducts of Rome delivered every day about 173,000,000 of our imperial gallons; and it is supposed that, when all the aqueducts together were in operation, upwards of 310,000,000 of imperial gallons of water were supplied to the ancient city. Now, reckoning the population of Rome to have been 1,000,000, which it probably never exceeded, no less than 300 gallons of water were allowed for the daily use of each inhabitant. Rarely, indeed, have cities, either ancient or modern, supplied their inhabitants with such quantities. According to the calculations of Prony, the French engineer, three aqueducts, the *Aqua Felice*, *Juliana*, and *Paulina*, with some additional sources, supply modern Rome with 33,000,000 of imperial gallons of water in 24 hours. This, divided among a supposed population of 150,000, gives about 220 imperial gallons of water for each inhabitant, being about one-third less than that which was furnished to the inhabitants when the city was the mistress of the nations, and at the height of her ancient splendour. We believe that London is at present far more plentifully supplied with water than even ancient Rome was, in proportion to her population, and at the period of her greatest prosperity; but we very much doubt whether the quality of the water supplied to the former would bear comparison with that supplied to the latter. It seems to us, indeed, that unless

the same method be adopted to bring water into London that was done in ancient Rome—namely, by aqueducts to conduct it from pure sources at a great distance, and at a very considerable elevation—the great desideratum of a constant and sufficient supply of pure water to the metropolis will never be obtained.

Aqueducts constructed for the purpose of irrigation, or for the supply of towns with water, often require architectural and engineering works as difficult and as important in their construction as canals for inland navigation, or railways for internal communication. Specimens of Roman architecture in these departments were given in our last lesson. Many are to be found in France. The aqueduct which supplies Nismes with water is of this description. Such also is the celebrated Pont du Gard, which is still in good preservation. As a specimen of modern skill, in that country, may be named the canal which brings the waters of the Durance down from the Pont de Férus, and conveys them to Marseilles after a passage of about 60 miles, of which nearly 11 are under ground. This canal or aqueduct passes across several deep valleys, over splendid aqueducts, such as the Juncourelle, the Valbonette, and the Valmousse. But the most remarkable specimen of modern canal architecture, of any that now exists, is the aqueduct of Roquefavour on the same canal. This wonderful structure is about 266 feet above the bottom of the valley over which it is built. It is composed of three rows of arches placed one above another, and is about 1,312 feet long. The beauty alone of this construction is not the most striking feature. The simplicity and elegance of the methods employed in its erection are especially worthy of admiration. We should like to see the skill of modern English architects and engineers employed in bringing the waters of some vast reservoir collected on some lofty eminence at a distance from the metropolis. Such water, filtered previous to transmission, and carried by simple gravitation along some splendid aqueduct, would pour into London a river of pure water, and render the office of the Sanitary Commissioners almost a sinecure.

LESSONS IN LATIN.—XXVII.

REGULAR VERBS.—THE SECOND CONJUGATION.

PASSIVE VOICE.

EXAMPLE.—Moneor, 2, I am reminded.

Chief Parts: Moneor, monitus sum, moneri. Characteristic letter, *e* long.

PRESENT TENSE.

	Indicative.	Subjunctive.	Imperative.	Infinitive.	Participle.
Sing.	Moneor.	Monear.		Moneri.	Moneri.
	Moneris.	Moneris.	Monere or mon-		
	Monetur.	Monetur.	Monitor.		
Plu.	Monemur.	Monemur.			
	Monemini.	Monemini.	Monemini.		
	Monentur.	Monentur.	Monentur.		

IMPERFECT TENSE.

Sing.	Monerbar.	Monerbar.			
	Monerbaris(e).	Monerbaris.			
	Moneretur.	Moneretur.			
Plu.	Moneremur.	Moneremur.			
	Moneremini.	Moneremini.			
	Monerentur.	Monerentur.			

FIRST FUTURE TENSE.

Sing.	Monerbor.	Monerbor.	Monitum	Monendus
	Monerbaris(e).	Monerbaris.	[iri]	
	Monerbitur.	Monerbitur.		
Plu.	Moneremur.	Moneremur.		
	Moneremini.	Moneremini.		
	Monerentur.	Monerentur.		

PERFECT TENSE.

Sing.	Monitus sum.	Monitus sis.	Monitum	Monitus
	Monitus es.	Monitus sis.	[esse]	
	Monitus est.	Monitus sit.		
Plu.	Moniti sumus.	Moniti simus.		
	Moniti estis.	Moniti sitis.		
	Moniti sunt.	Moniti sint.		

PLUPERFECT TENSE.

Sing.	Monitus eram.	Monitus essem.		
	Monitus eras.	Monitus esses.		
	Monitus erat.	Monitus esset.		
Plu.	Moniti eramus.	Moniti essemus.		
	Moniti eratis.	Moniti essetis.		
	Moniti erant.	Moniti essent.		

SECOND FUTURE TENSE.			
Sing.	Monitus ero.	Plu.	Moniti erimus.
	Monitus eris.		Moniti eritis.
	Monitus erit.		Moniti erunt.

EXERCISES.—According to this model, form *habeor*, I am possessed; *terreo*, I am frightened; *exerceor*, I am exercised.

VOCABULARY.

Augere, augere, auxi, augm., I increase (E. R. augment).	Deterreo, 2, I frighten from, deter.	Obsideo, -onis, f., block-ade.
Castra, -orum, a camp. (Castrum, of which Castra is the plural, means a castle or fortress.)	Difficultas, -tatis, f., difficulty.	Oppleo, opplere, opplevi, oppletum, 2, I fill up.
Cingo, cingere, cinxi, cinctum, 3, I surround.	Extemplo, adv., forth-with.	Postquam, afterwards.
Cognitio, -onis, f., knowledge.	Fossa, -e, f., a ditch, moat.	Propositum, -i, n., a proposition, design.
Despero, 1, despair.	Honor or Honos, -oris, m., honour, dignity.	Strenue, earnestly, strenuously.
	Jungo, jungere, junxi, junctum, 3, I join.	Subitus, -a, -um, sudden.
	Naturalis, -e, natural.	Vivo, vivere, vixi, victum, 3, I live.

EXERCISE 94.—LATIN-ENGLISH.

1. Exerceor. 2. Exerceor. 3. Exerceor. 4. Exerceor. 5. Exerceor. 6. Exerceor. 7. Exerceor. 8. Exerceor. 9. Exerceor. 10. Pater curat ut ego bene exercear. 11. Oppletur fossa. 12. Curo ut bene exercear. 13. Curo ut puer bene exerceatur. 14. Pater curabat ut filius bene exerceatur. 15. Curabam ut bene exerceeris. 16. Curabam ut filia tua bene exerceatur. 17. Quis nescit quam preclaris fructibus animi nostri in literarum studiis augentur? 18. Timemus ne exercitus noster ab hostibus vincatur. 19. Omnes cives metuebant ne urbs ab hostibus obsidione cingeretur. 20. Quum in literis exercebam, animi nostri multarum rerum utilium cognitione augentur. 21. Quum subito periculo terremur, non debemus exemplo de salute desperare. 22. Virtutis honos nulla obliquo delectatur. 23. Pueri in literarum studiis strenue exerciti sunt. 24. Metuebamus ne urbs ab hostibus obsidione cincta esset. 25. Metuo ne milites subito periculo terri sint. 26. Strenue exerceor puer. 27. Ne rerum difficultatibus a proposito deterretor. 28. Boni discipuli student exerceo in literarum studiis. 29. Puer bene educatus omnibus placeat. 30. Hostes terri in castris manent. 31. Pueri strenue exerceant sunt.

EXERCISE 95.—ENGLISH-LATIN.

1. The boys are earnestly exercised. 2. Let boys be earnestly exercised. 3. The boys must be strenuously exercised. 4. The boys will be strenuously exercised. 5. The boys are strenuously exercised. 6. The boys were being strenuously exercised. 7. The boys have been strenuously exercised. 8. The boys will have been strenuously exercised. 9. I take care that the boys are (may be, in Latin) strenuously exercised. 10. I took care the boys were (might be) strenuously exercised. 11. My sisters have been strenuously exercised. 12. The girl will have been strenuously exercised. 13. I fear the city will be surrounded with a blockade (blockaded).

THE THIRD CONJUGATION.

ACTIVE VOICE.

EXAMPLE.—Lego, 3, I read.

Chief Parts: Lego, legi, lectum, legere. Characteristic letter, *i* short.

PRESENT TENSE.

	Indicative.	Subjunctive.	Imperative.	Infinitive.	Participle.
Sing.	Lego.	Legam.		Legere.	Legens.
	Legis.	Legas.	Leges, or legis.		
	Legit.	Legit.	Legito.		
Plu.	Legamus.	Legamus.			
	Legitis.	Legitis.	Legite, or legi.		
	Legunt.	Legunt.	Legunt.		

IMPERFECT TENSE.

Sing.	Legerem.	Legerem.			
	Legerem.	Legerem.			
	Legeret.	Legeret.			
Plu.	Legeremus.	Legeremus.			
	Legeratis.	Legeratis.			
	Legerant.	Legerant.			

FIRST FUTURE TENSE.

Sing.	Legam.	Legam.	Lectum	Lecturus.
	Legas.	Legas.	[esse]	
	Legit.	Legit.		
Plu.	Legamus.	Legamus.		
	Legatis.	Legatis.		
	Legant.	Legant.		

PERFECT TENSE.

Sing.	Legi.	Legi.	Legisse.
	Legisti.	Legisti.	
	Legit.	Legit.	

Plu.	Legimus.	Legimus.	Legimus.
	Legitis.	Legitis.	Legitis.
	Legerunt (ere).	Legerunt.	Legerunt.

PLUPERFECT TENSE.

Sing.	Legissem.	Legissem.	
	Legissem.	Legissem.	
	Legisset.	Legisset.	
Plu.	Legissemus.	Legissemus.	
	Legissetis.	Legissetis.	
	Legissent.	Legissent.	

SECOND FUTURE TENSE.

Sing.	Legero.	Legero.	
	Legeris.	Legeris.	
	Legerit.	Legerit.	
Plu.	Legerimus.	Legerimus.	
	Legeritis.	Legeritis.	
	Legerint.	Legerint.	

GERUNDS.

Gen.	Legendi.
Dat.	Legendo.
Acc.	Legendum.
Abl.	Legendo.

SUPINES.

1. Lectum.
2. Lectu.

Instances.—After this model write out *fundo*, fundere, fudi, fusum, I pour; *tribuo*, tribuere, tribui, tributum, I bestow; and *scribo*, scribere, scripsi, scriptum, I write.

VOCABULARY.

Acies, -ei, f., a line of battle.	defendi, defensum, 3, I defend.	gestum, 3, I carry on.
Coerceo, coercere, coercui, coercitum, 2, I restrain.	Dico, dicere, dixi, dictum, 3, I say.	Instruo, instruere, instrui, instructum, 3, I dry up, form (E. R. instruct).
Comburo, comburere, combussi, combustum, 3, I burn.	Disco, discere, didici, I learn.	Libenter, willingly.
Corrigo, corrigere, correx, correctum, 3, I correct.	Duco, ducere, duxi, ductum, 3, I lead.	Pingo, pingere, pinxi, pinctum, 3, I paint (E. R. picture).
Defendo, defendere, Gero, gerere, gessi, Simulacrum, as soon as.	Excolo, excolere, excoli, excolitum, 3, I cultivate.	Quoad, as long as.

EXERCISE 96.—LATIN-ENGLISH.

1. Durimus. 2. Duristi. 3. Duci. 4. Ducebam. 5. Ducet. 6. Ducat. 7. Dum ego pingebam, tu scribebas, et frater legebat. 8. Hostes aciem instruebant. 9. Quoad vives bene vives. 10. Si virtutem coletis, boni te diligunt. 11. Hostes aciem instruxerunt. 12. Hostes aciem instruent. 13. Multas literas hodie scripsimus. 14. Bellum atrocissimum gesserunt hostes. 15. Caesar aciem instruxerat. 16. Simulacrum literas scripsimus ambulabimus. 17. Curo ut puerorum animos excolam. 18. Curabam ut filii mei preceptor animam excoleret. 19. Nemo dubitat quin ego puerum semper diligenter correxerim. 20. Metuimus ne hostes urbem combusserint. 21. Nemo dubitat quin hostes urbem obsidione cincturi sint. 22. Narrate nobis quid parentes scripserint. 23. Scribit. 24. Disco, puer. 25. Boni pueri libenter discunt. 26. Miles, se fortiter contra hostes defendens, laudatur. 27. Cupiditates coercere debemus.

EXERCISE 97.—ENGLISH-LATIN.

1. I defended the city. 2. The soldiers defended the city. 3. They will defend the city. 4. They have defended the city. 5. They were writing. 6. He has written a letter. 7. No one doubts that you will write a good letter. 8. Take care to write a letter. 9. The teacher takes care that his scholars write good letters. 10. I have written a letter to-day. 11. The enemies will draw up (their) line of battle. 12. The soldiers have burnt the city. 13. I have read the letter which thou wrotest. 14. I fear that the enemies will blockade the city. 15. Correct that boy. 16. The master will take care to correct his scholars. 17. Tell (narro) me what thou saidst to thy father. 18. Restrain thy desires. 19. We ought to restrain our desires. 20. A boy (by) restraining his desires is loved. 21. Strenuously cultivate thy mind, my son.

KEY TO EXERCISES IN LESSONS IN LATIN.—XXVI.

EXERCISE 92.—LATIN-ENGLISH.

1. I exercise. 2. I was exercising. 3. He was exercising. 4. I will exercise. 5. I rejoice that thou art well. 6. The teacher was rejoicing that you were obeying his commands. 7. Thou wast pleasing thyself, (thou wast) displeasing others. 8. No forgetfulness will blot out the honour of virtue. 9. I exercised. 10. Greece flourished in all the arts. 11. I praise you because you have properly exercised your mind in study. 12. Why were you silent? 13. Thy boy was suddenly silent. 14. The mother was silent. 15. All are silent. 16. Unless you have obeyed the precepts of virtue, the entrance to heaven will not be open to you. 17. If thou hast restrained thy desires thou wilt be happy. 18. I take care to improve (that I may improve) the morals and to exercise the body of the boy. 19. I advise you to observe (that

you may observe) the commands of your father. 20. I feared I was displeasing you. 21. Take care to improve the morals and to exercise the body of the boy. 22. I feared that an enemy was injuring me. 23. The boy feared that his mother was silent. 24. I took care to improve (that I might improve) the morals and to exercise the body of the boy. 25. I took care that you should improve the morals and (that you should) exercise the body of the boy. 26. I took care that the teacher should improve the morals and exercise the body of the boy. 27. I fear that you will (may) not come. 28. The husband fears that his wife will (may) die. 29. The teacher feared that the scholar would not obey his words. 30. The bad boy fears that the teacher will come.

EXERCISE 93.—ENGLISH-LATIN.

1. Ille me monebat. 2. Illi regem monebant. 3. Ego vos monebam. 4. Vos me monebatis. 5. Illi puerum monebant. 6. Tu mulierem monebas. 7. Ego preceptorem monebo. 8. Tace. 9. Taceat. 10. Taceatis. 11. Mulier repente tacuit. 12. Cura ut emendes. 13. Cura ut civium mores emendes. 14. Timeo ne tibi displiceat. 15. Pueri timebant ne patri displicerent. 16. Omnibus placet. 17. Bonus malis displicebat. 18. Cur taces? 19. Metuunt ne Caesar patriam vincat. 20. Bonae sorores timent ut fratres valeant. 21. Valesne? 22. Timeo ut valeas. 23. Si corpus exercueris valabis. 24. Mater timet ut mihi aditus in caelum pateat.

LESSONS IN ALGEBRA.—I.

DEFINITIONS.

ART. 1.—ALGEBRA is a general method of solving problems, and of investigating the relations of quantities by means of letters and signs.

The following will afford illustrations of this method of arriving at the solutions of problems by the use of signs and letters instead of figures as in arithmetic.

PROBLEM I.—Suppose that a man divided 72 pounds among his three sons in the following manner:—To A he gave a certain number of pounds; to B he gave three times as many as to A; and to C he gave the remainder, which was half as many pounds as A and B received. How many pounds did the donor give to each?

To solve this problem arithmetically, the pupil would reason thus:—A had a certain part, that is one share; B received three times as much, or three shares; but C had half as much as A and B; hence he must have received two shares. By adding their respective shares, the sum is six shares, which, by the conditions of the question, is equal to 72 pounds. If, then, 6 shares are equal to 72 pounds, 1 share is equal to $\frac{1}{6}$ of 72, namely, 12 pounds, which is A's share. B had three times as many, namely, 36 pounds; and C half as many pounds as both, namely, 24 pounds.

Now, to solve the same problem by algebra, he would use letters and signs, thus:

Let x represent A's share; then by the conditions, x multiplied by 3, or $x \times 3$ (when $\times$, the sign of multiplication, is used instead of the words "multiplied by"), will represent B's share, and

$4x$, the sum of the shares of A and B divided by 2, or $4x \div 2$ (when $\div$, the sign of division, is used instead of the words "divided by"), will represent C's share.

Now, $x \times 3$ may be written $3x$, and $4x \div 2$ may be written $2x$; so then adding together the several shares of A, B, and C, namely, x , $3x$, and $2x$, and putting $+$, the sign of addition, between them, we get $x + 3x + 2x$, which is equal to $6x$; or using $=$, the sign of equality, for the words "is equal to," we get $x + 3x + 2x = 6x$. Then $6x = 72$, for the whole is equal to all its parts; and $1x = 12$ pounds, A's share; $3x = 36$ pounds, B's share; and $2x = 24$ pounds, C's share.

Proof.—Add together the number of pounds received by each, and the sum will be equal to 72 pounds, the amount divided between A, B, and C.

In this algebraic solution it will be observed: First, that we represent the number of pounds which A received by x . Second, to obtain B's share, we must multiply A's share by 3. This multiplication is represented by two lines crossing each other like a capital X. Third, to find C's share, we must take half the sum of A's and B's share. This division is denoted by a line between two dots. Fourth, the addition of their respective shares is denoted by another cross formed by an horizontal and a perpendicular line. Take another example:—

PROBLEM II.—A boy wishes to lay out 96 pence for peaches and oranges, and wants to get an equal number of each. He

finds that he must give 2 pence for a peach, and 4 pence for an orange. How many can he buy of each?

Let x denote the number of each. Now, since the price of one peach is 2 pence, the price of x peaches will be $x \times 2$ pence, or $2x$ pence. For the same reason, $x \times 4$, or $4x$ pence, will denote the price of x oranges. Then will $2x + 4x$, or $6x$, be equal to 96 pence by the conditions of that question, and $1x$ or x (for when 1 is the co-efficient of a number [See Art. 16 below] it is always understood, and never expressed) is equal to $\frac{1}{6}$ of 96 pence, namely, 16 pence, and 16 is therefore the number he bought of each.

2. Quantities in algebra are generally expressed by letters, as in the preceding problems. Thus b may be put for 2 or 15, for any other number which we may wish to express. It must not be inferred, however, that the letter used has no determinate value. Its value is fixed for the occasion or problem on which it is employed, and remains unaltered throughout the solution of that problem. But on a different occasion, or in another problem, the same letter may be put for any other number. Thus, in Problem I., x was put for A's share of the money. Its value was 12 pounds, and remained fixed through the operation. In Problem II., x was put for the number of each kind of fruit. Its value was 16, and it remained so throughout the whole of the calculation.

3. By the term quantity, we mean anything that can be multiplied, divided, or measured. Thus, length, weight, time, number, etc., are called quantities.

4. The first letters of the alphabet, a, b, c , etc., are used to express known quantities; and the last letters, x, y, z , etc., those which are unknown.

5. Known quantities are those whose values are given, or may be easily inferred from the conditions of the problem under consideration.

6. Unknown quantities are those whose values are not given, but required.

7. Sometimes, however, the given quantities, instead of being expressed by letters, are given in figures.

8. Besides letters and figures, it will also be seen that we use certain signs or characters in algebra to indicate the relations of the quantities, or the operations which are to be performed with them, instead of writing out these relations and operations in words. Among these are the signs of addition (+), subtraction (−), equality (=), etc.

9. Addition is represented by two lines (+), one horizontal, the other perpendicular, forming a cross, which is called plus. It signifies "more," or "added to." Thus $a + b$ signifies that b is to be added to a . It is read a plus b, or a added to b, or a and b.

10. Subtraction is represented by a short horizontal line (−) which is called minus. Thus, $a - b$ signifies that b is to be "subtracted" from a ; and the expression (see Art. 22 below) is read a minus b, or a less b.

11. The sign $+$ is prefixed to quantities which are considered as positive or affirmative; and the sign $-$ to those which are supposed to be negative. For the nature of this distinction, see Articles 36 and 37.

12. The sign is generally omitted before the first or leading quantity, unless it is negative; then it must always be written. When no sign is prefixed to a quantity, $+$ is always understood. Thus $a + b$ is the same as $+a + b$.

13. Sometimes both $+$ and $-$ (the latter being put under the former, $\pm$) are prefixed to the same letter. The sign is then said to be ambiguous. Thus $a \pm b$ signifies, that in certain cases, comprehended in a general solution, b is to be added to a , and in other cases subtracted from it.

Observation.—When all the signs are plus, or all minus, they are said to be alike; when some are plus and others minus, they are called unlike.

14. The equality of two quantities, or sets of quantities, is expressed by two parallel lines, $=$. Thus $a + b = d$ signifies that a and b together are equal to d . So $8 + 4 = 16 - 4 = 10 + 2 = 7 + 2 + 3$.

15. When the first of the two quantities compared is greater than the other, the character $>$ is placed between them. Thus $a > b$ signifies that a is greater than b .

If the first is less than the other, the character $<$ is used; as $a < b$, namely, a is less than b . In both cases, the quantity towards which the character opens is greater than the other.

READINGS IN GERMAN.—I.

INTRODUCTION.

THE object of learning a modern language is not simply, as in the case of one that is no longer spoken, to be able to read and write, but also to speak it. For this purpose it is obviously necessary to acquire a knowledge of the pronunciation as well as the meaning of the words. Hence we are not surprised at having received many applications from the readers of our lessons in German for some instruction on this subject; and it is our intention to publish in the pages of the POPULAR EDUCATOR a series of German Reading Lessons expressly prepared with a view to teach the proper pronunciation of the language. These lessons will be found much better adapted to answer the purpose than any mere collection of rules, however carefully drawn up, and however clearly expressed. In no case is the principle, that example is better than precept, more applicable than in that of pronunciation, a knowledge of which can only be acquired by frequent exemplification. We have no hesitation in saying that the study of our lessons will enable the reader to pronounce German, if not with absolute perfection, at least so as to be easily understood by a native, which is, after all, the only practical object in view.

It is proper to observe, that whilst the lessons are especially intended to teach pronunciation, they are also calculated to be very useful to our readers as exercises in translation, being easy in construction, simple in style, rich in words, and adapted in substance to persons of all ages. A vocabulary will be appended to each lesson, containing an explanation of the meaning of every word in it which has not been previously explained. As few words will be explained more than once in the whole course of the vocabularies, it will be necessary for the learner to study each with great care on its first occurrence, that he may avoid the inconvenience of having to look through preceding pages for the meaning.

DIRECTIONS FOR THE USE OF THE INTERLINEAR PRONUNCIATION.

Pronounce every syllable as in English.

To make a vowel long which otherwise would be short, or might be either short or long, an apostrophe has been placed immediately after that vowel. Thus *vol* will rhyme with *doll*, but *vo'l* will rhyme with *whole*.

To make a vowel short which otherwise would be long, or might be either long or short, the short sign or breve has been placed over that vowel. Thus *mild* will rhyme with *wild*, but *mild* will rhyme with *build*. *Boot* will rhyme with *root*, but *bööt* will rhyme with *put*.

ah is long, and sounded as in *father*; *a* is short, and sounded as in *castle*.

ey is to be pronounced as in *obey*.

at, representing the short sound of *e*, when unaccented and terminating a syllable, should be pronounced like *ey* in the noun *sur-vey*. The letters *ey* could not well be used for this sound, as they have generally the sound of *ee* when unaccented.

ö has no corresponding sound in English; place the organs as if to pronounce *o* long; keep them exactly in this position, and then try to pronounce the German *e* or English *a*. For the short sound of this vowel place the organs again as if to pronounce *o*, and without changing, try to pronounce *ef*, *el*, *eck*, *em*, *en*, *ep*, *er*, *ess*, *et*, and you will utter the sound required. The sound which comes nearest to it is the *e* in *her*.

ü has no parallel in English. Pronounce *oo* in *oose*, firmly maintain this position, and try to pronounce long *e* in *cel*; the sound uttered will be the one required. For the short sound, place the organs in a similar position, and without changing it try to say *if*, *il*, *ick*, *im*, *in*, *ip*, *ir*, *iss*, *it*. For those who have studied French it may be well to remark that the German *ü* has the same sound as the French *u*.

ou is always to be sounded as in *out*, *our*.

gh before *e* and *i* must be pronounced like *g* in *get*, *gimlet*.

q has different sounds, according to its position in the word. In the interlinear pronunciation we shall denote it by—
q, when it is pronounced like an aspirated *k*, or like the

16. A numeral figure is often prefixed to a letter. This is called a co-efficient. It shows how often the quantity expressed by the letter is to be taken. Thus 2b signifies twice b; and 9b, 9 times b, or 9 multiplied into b.

The co-efficient may be either a whole number or a fraction. Thus $\frac{2}{3}b$ is two-thirds of b . When the co-efficient is not expressed, 1 is always to be understood. Thus a is the same as $1a$, that is to say, once a , or one times.

17. The co-efficient may also be a letter, as well as a figure. In the quantity mb , m may be considered the co-efficient of b ; because b is to be taken as many times as there are units in m . If m stands for 6, then mb is six times b . In $3abc$, 3 may be considered as the co-efficient of abc ; 3a the co-efficient of bc ; or 3ab the co-efficient of c .

18. A simple quantity is either a single letter or number, or several letters connected together without the signs $+$ or $-$. Thus a , ab , abd , and $8b$, are each of them simple quantities.

19. A compound quantity consists of a number of simple quantities connected by the sign $+$ or $-$. Thus $a + b$, $d - y$, $b - d + 3h$, are each compound quantities. The members of which each is composed are called terms.

20. A simple term is called a monomial; thus, a , b , $-c$ are monomials. If there are two terms in a compound quantity, it is called a binomial: thus $a + b$ and $a - b$ are binomials. The latter term ($a - b$) is also called a residual quantity, because it expresses the difference of two quantities, or the remainder after one is taken from the other. A compound quantity, consisting of three terms, is sometimes called a trinomial; one of four terms, a quadrialomial. A quantity consisting of several terms is, however, generally called a polynomial.

21. When the several members of a compound quantity are to be subjected to the same operation, they are connected by a line called a vinculum (—), or by a parenthesis (). Thus $a - b + c$, or $a - (b + c)$, shows that the sum of b and c is to be subtracted from a . But $a - b + c$ signifies that b is to be subtracted from a , and c is to be added to the result.

22. A single letter, or a number of letters, representing any quantities with their relations, is called an algebraic expression or formula. Thus $a + b + 3d$ is an algebraic expression.

23. Multiplication is usually denoted by two oblique lines crossing each other, thus $\times$: hence, $a \times b$ is a multiplied into b ; and 6×3 is 6 times 3, or 6 multiplied into 3. Sometimes a point is used to indicate multiplication: thus, $a.b$ is the same as $a \times b$. But the sign of multiplication is more commonly omitted between simple quantities, and the letters are connected together in the form of a word or syllable: thus, ab is the same as $a \times b$ or $a.b$; and bcd is the same as $b \times c \times d \times e$. When a compound quantity is to be multiplied, a vinculum or parenthesis is used, as in the case of subtraction. Thus the sum of a and b multiplied into the sum of c and d , is $(a + b) \times (c + d)$, or $(a + b)(c + d)$. And $(6 + 2) \times 5$ is 8×5 , or 40. But $6 + (2 \times 5)$ is $6 + 10$, or 16. When the marks of parenthesis are used, the sign of multiplication is frequently omitted. Thus $(x + y)(x - y)$ is $(x + y) \times (x - y)$.

24. When two or more quantities are multiplied together, each of them is called a factor. In the product ab , a is a factor, and ap is b . In the product $x \times (a + m)$, x is one of the factors, and $(a + m)$ the other. Hence every co-efficient may be considered as a factor (Art. 17). In the product $3y$, 3 is a factor as well as y .

25. A quantity is said to be resolved into factors, when any factors are taken which, being multiplied together, will produce the given quantity. Thus $3ab$ may be resolved into the two factors $3a$ and b , because $3a \times b$ is $3ab$. And $5amm$ may be resolved into the three factors $5a$, and m , and n . And 48 may be resolved into the two factors 2×24 , or 3×16 , or 4×12 , or 6×8 ; or into the three factors $2 \times 3 \times 8$, or $4 \times 6 \times 2$, etc.

26. Division is expressed in two ways: (1.) By an horizontal line between two dots $\div$, which shows that the quantity preceding it is to be divided by that which follows. Thus $a \div c$, is a divided by c .

(2.) Division is more commonly expressed in the form of a fraction, putting the dividend in the place of the numerator, and the divisor in that of the denominator. Thus $\frac{a}{b}$ is a divided by b .

oh in the Scotch word *loch*. It has this sound after the vowels *a, o, u, au*; by—
 "j," when it is pronounced like an aspirated *y*. It has this sound in all other German words; by—
 "k," when it is pronounced like *k*. It has this sound in most words derived from the Greek and before *s*, unless this *s* belongs to the next syllable, or is an inflection; by—
 "sh," when it is pronounced like *sh* in English. It has this sound in words derived from the French.

We shall transcribe *g* in the same manner, whenever it is pronounced in one of these ways.

1.—Das Rothfischchen.

Dass rote-keyl-yen chen.

Ein Rothfischchen kam in der Strenge des Winters an das rote-keyl-yen kahn in dair shtreng-al dess win-ters an dass Fenster eines frommen Landmanns, als ob es gern hinein fei-ster i-ness from'men lant-manns, als ob ess gern hin-ine möchte. Da öffnete der Landmann sein Fenster und nahm moy-tai. Dah of-nai-tai dair lant-man zine fen-ster dunt nahm das zutrauliche Thierchen freundlich in seine Wohnung. Nun dass too'-trou-li-ye teer-yen froint-li-y in zi-nai vo'-nōnk. Noon püfte es die Brämen und Fränschen auf, die von seinem pick-tai ess dee bro'-zah-men dunt krū'm'-yen auf, dee fōn zi-nem Tische felen. Auch hielten die Kinder des Landmanns das tish-shai fee-len. Auch heyl-ten dee kin'-der dess lant-manns, dass Wöglein lieb und werth. Aber als nun der Frühling wieder in fōg-line leep dunt veirt. ah-ber als noon dair frū'-link vee'-der in das Land kam und die Gschüße sich belauten, da öffnete dass lant kahn dunt dee gai-bash-shai ziy bai-laup'-ten, dah of-nai-tai der Landmann sein Fenster, und der kleine Gast entfloß in das dair lant-man zine fen-ster, dunt dair kli-nai gast ent-flo'-ch in dass nahe Wäldchen, und baute sein Nest und sang sein frohliches nah'-hai velt'-yen, dunt bou-ai-tai zine nest dunt zank zine frō'-li-yeess Riechen. leet'-yen.

Und siehe, als der Winter wiederkehrte, da kam das Rothfischchen abermals in die Wohnung des Landmanns und keyl-yen ah-ber-mahles in dee vo'-nōnk dess lant-manns dunt hatte sein Weibchen mitgebracht. Der Landmann aber sammt hat-tai zine vipe'-yen mit'-gai-bracht. Dair lant-man ah-ber zamt seinen Kindern freuten sich sehr, als sie die beiden Thierchen sahen, zi-nen kin'-derm froi'-ten ziy sehr, als zee dee bi'-dentee'-yen zah'-hen, wie sie aus den kleinen Augen zutraulich umherguckten; vee zee ous dain klah'-ren oig-line too'-trou-li-y dūm-heyr-shou'-ten; und die Kinder sagten: Die Wöglein sehen uns an, als ob dunt dee kin'-der zah'-ten: Dee fō'-ghel-yen zey'-hen dūss an, als ob sie etwas sagen wollten. zee et'-vass zah'-ghen vōl'-ten.

Da antwortete der Vater: Wenn sie reden könnten, so Dah ant'-vōr-tai dair fah'-ter: Ven zee rey'-den kōn'-ton, zo' würden sie sagen: Freundschaftes Zutrauen erwecket vū'-den zee zah'-ghen: Froint-li-yeess too'-trou-en err-reck-et Zutrauen, und Liebe erzeugt Gegenliebe! too'-trou-en, dunt lee'-hai err-tsoi'-ghet ghey'-ghen-lee'-hai!

VOCABULARY.

Das, n. the.	An, to.	Einem, into (him, along, towards).
Rothfischchen, n. red-broast (with red; f. throat; -chen, affix, sign of diminutive).	Fenster, n. window.	Da, then, there.
Fin, a. one.	Eines, gen. m. and n. of a, of one.	Öffnen, to open.
Kommen, to come.	Fromm, pious.	Sein, his.
Der, f. dat. the, to the.	Landmann, m. coun-tryman.	Und, and.
Strenge, f. severity.	Als, as, when.	Nehmen, to take.
Des, gen. m. and n. of the.	Ob, if, whether.	Zutraulich, confiding (trauen, to trust).
Winter, m. winter.	Es, it.	Thier, n. animal.
	Geru, willingly, with pleasure (Geru, mögen, to like; fem. men, understood).	Freundlich, friendly, kind (freund, m. friend; -lich, affix, like -ly).

Wohnung, f. dwell-ing (wohnen, to dwell, reside, live).
 Nun, now, well.
 Picken, to pick.
 Die, pl. the.
 Brämen, pl. scraps.
 Krume, f. crum.
 Auf, up, upon, on.
 Die, relative pronoun pl. which.
 Von, of, from.
 Tisch, m. table.
 Fallen, to fall.
 Auch, also.
 Kind, n. child.
 Vogel, m. bird (-lein, sign of diminutive).
 Lieb halten, to love.
 Werth halten, to es-teeem, cherish (halten, to hold).
 Aber, but.
 Der, nom. m. the.
 Frühling, m. spring.
 Wieder, again, preposi-tion.
 Thierchen, n. collective noun, bushes, copse (ge-, a prefix, showing a mass of things; Püsch, m. bush).
 Sich, himself, herself, itself, themselves.
 Belauben, to cover with foliage (Laub, foliage).

klein, small.
 Gast, m. guest.
 Entfliegen, to fly a-way (ent-, prefix, away, up, forward).
 Ein, acc. m. the.
 Nahe, near.
 Wald, m. forest.
 Bauen, to build.
 Singen, to sing.
 Fröhlich, merry (fröh, glad, cheerful).
 Lied, n. song, hymn, air.
 Sehen, to see, to look.
 Kehren, to turn.
 Wieder, again.
 Weibchen, n. Weib, n. mate, female, wife.
 Mit, with; fringen, to bring; haben, to have.
 Sammt, together with.
 Freuen, to enjoy, re-joice.
 Sehr, very, much.
 Beid, both.
 Wie, how, as, like.
 Aus, out, out of.
 Klar, clear.
 Auge, n. eye (Auglein, n. diminutive, small eye, beauti-ful eye).

Umher, around, about; schauen, to look.
 Ansehen, to look at (an, prep. and pre-fix, at, to, by).
 Etwas, something, anything.
 Wollen, to wish, want, be willing.
 Antworten, to answer (Antwort, f. an-swer).
 Vater, m. father.
 Wenn, if, when.
 Sie, they, them, she, her.
 Sagen, to speak (Sate, f. speech).
 Können, to be able, can.
 Würden, would, should, sign of the conditional mood.
 Sagen, to say.
 Zutrauen, n. confi-dence.
 Erwachen, to awake.
 Liebe, f. love (Lieben, to love).
 Erzeugen, to engender, beget.
 Gegen, preposition and prefix, coun-ter, against.

KEY TO EXERCISES IN LESSONS IN GERMAN.

EXERCISE 60 (Vol. I., page 302).

1. These great beautiful houses are all to let. 2. The one house is to let, the other to sell. 3. It is not to be believed that he has forsaken us. 4. This book is to be had of Mr. Westermann in Bruns-wick. 5. Not one single star was to be seen in the whole heavens. 6. How is this long word to be pronounced? 7. Where are the best boots, shoes, and over-shoes to be found? 8. The best, which I have seen, are to be found at my old neighbour N's. 9. The fire burnt so rapidly that nothing was to be saved in the castle. 10. Nothing valu-able is to be gained without trouble. 11. This high rock is not to be climbed. 12. This old house is to be repaired no more. 13. Through this forest one cannot get. 14. He is neither to be convinced nor to be persuaded. 15. His behaviour is not at all to be pardoned. 16. What is your friend's name? 17. He is called James. 18. How is this called in German? 19. It is called Brille (spectacles). 20. The more perfect a work of art is, that is, the more parts it has, and the more all these parts contribute to the purpose, the more beautiful it is.

EXERCISE 61 (Vol. I., page 302).

1. Die Aussprache fremder Wörter ist nur durch Übung zu erlernen. 2. Nichts ist ohne Mühe zu erlernen. 3. Vollkommene Glückseligkeit ist in dieser Welt nicht zu finden. 4. Sie sprechen so schnell, daß Sie nicht zu verstehen sind. 5. Gesundheit ist mit Geld nicht zu kaufen. 6. Die Ruhe der Stadt war durch strenge Befehle nicht herzustellen. 7. Wie nennen Sie diese Blumen? 8. Sie werden Tulpen genannt. 9. Die Augen Schiller sind zu leben. 10. Der Unterschied zwischen kaufen und verkaufen muß den Schülern zu dieser Zeit bekannt sein. 11. Dieses Buch ist bei dem Buchhändler G. in London zu haben. 12. Ein werthvolles Kunstwerk kann nicht ohne viel Mühe gemacht werden. 13. Die Rose und das Veilchen werden wegen ihres Wohlgeruchs geschätzt, die Tulpe wegen des Glanzes ihrer Farben. 14. Sofort geht morgen nach Braunschweig. 15. Die Himmel verfügbaren die Herrlichkeit Gottes.

EXERCISE 62 (Vol. I., page 302).

1. Where are you sending your servant? 2. He is ill, he can go no-where. 3. Do you copy this letter? 4. I have already copied it. 5. Do you believe that the bookbinder sends me back my books? 6. Has your sister received the flowers which I have bought for her? 7. The gardener comes to-morrow, and will bring them with him. 8. When does John go to school? 9. He goes there to-morrow, and little

Henry goes too. 10. Where are the new tables which the joiner has made? 11. Have you seen the beautiful carriage, in which Mr. G. has taken his wife and children away? 12. When does your brother come back from Paris? 13. He has already been back these five days. 14. Do you wish to take a walk? 15. No, I have already taken a walk round the town.

EXERCISE 63 (Vol. I., page 302).

1. Er war im Begriffe uns mitzutheilen, was er geschrieben hatte, aber er wurde durch die Ankunft eines Fremden unterbrochen. 2. Wann ist Ihr Großvater Schwester nach Frankreich abgereist? 3. Sie ist vorgestern abgereist. 4. Hat sie die kleine Maria mitgenommen? 5. Es wird sehr schwer sein, sein Betragen mit den Umständen zu erklären, zu welchen er sich bekennt, übereinstim-mend zu machen. 6. Ihr, die ihr eure Freunde verlassen habt, seid keines Vertrauens würdig. 7. Gute Frauen sind die reizendste Klasse der Gesell-schaft, sie trösten uns, erheben unser Gemüth, begründen unser Glück, und haben keine Eitelkeit, als die, welche wir ihnen mittheilen.

EXERCISE 64 (Vol. I., page 303).

1. We are growing older and older, and are sooner at our end than is agreeable to us. 2. It became so dark that we were not able to see our hands before our eyes. 3. At five o'clock it grows dark. 4. Do you rise early in the morning? 5. As soon as it is light, I leave my bed. 6. Shall you still emigrate this year to America? 7. I intend it, but I do not think anything will come of it. 8. In the year one thousand eight hundred and forty-eight, France became a republic. 9. God said, Let it be, and it was. 10. Is your new grammar already finished? 11. Not yet, but I hope it will be finished in a fortnight at the latest. 12. What will become of me? 13. "It will be a hot day," said an old warrior to his comrades a few hours before the battle. 14. The sun sunk in the sea, and it became night. 15. The sick man on his couch says, with a sigh, "Will it, then, never be day?" and the day-labourer, under the pressure of his work (says), "Will it not soon be night?" 16. The weather has already become rather cold.

EXERCISE 65 (Vol. I., page 303).

1. Die Gegenwart kennen wir, von der Zukunft wissen wir nichts, und Effe-tem Menschen, der ruhig die Zukunft erwarten kann. 2. Wurde Ihre Schwester plötzlich krank? 3. Nein, sie fühlte sich acht Tage zuvor heftiges Kopfschmerz. 4. Wollen Sie ein geleiteter Mann werden? 5. Fast uns nach Hause gehen, die ist dunkel wird. 6. Die meisten Menschen werden krank durch Vernachlässigung. 7. Mancher wurde ein ganz anderer Mensch, nachdem er eine sorgfältigere Erziehung erhalten hatte. 8. Die meisten Menschen werden Elaven des Reichthums anstatt Herren desselben. 9. Sobald es Frühling wird, befreit die ganze Natur sich wieder.

EXERCISE 66 (Vol. I., page 310).

1. How old is this man? 2. He is not very old. 3. Has he much money? 4. Yes, and he has also many friends and many enemies. 5. Which boy has many apples and pears? 6. One of the peasant's sons has many apples, the other has many pears. 7. The one has much success, the other only grief and anxiety. 8. How much bread has the baker? 9. He has very much bread, but only a little flour. 10. This man has little money, but much intelligence. 11. These boots are much too large for me, and the shoes are a little too short for my brother. 12. Will your uncle buy much powder? 13. He will buy only a little, because he has too little money. 14. Who is that? 15. It is an old friend of the physician. 16. Who has good water? 17. The sailor has some. 18. Shall I have some books to-morrow? 19. You will have some to-day already. 20. Has the peasant much wheat? 21. He has not much. 22. Has the blacksmith much steel? 23. He has much. 24. Has he many nails? 25. He has many. 26. Who has milk? 27. The peasant has some. 28. Has he very much? 29. He has enough.

EXERCISE 67 (Vol. I., page 310).

1. Wir müssen vorsichtig in der Wahl desjenigen sein, dem wir wich-tige Angelegenheiten anvertrauen. 2. Diejenigen, welche übel von andern reden, sind oft schlimmer als die, deren Fehler sie beschreiben. 3. Er be-kannte die Religion, deren Ursprung göttlich ist. 4. Dieser Knabe besaß zu viel Stolz und zu wenig Fleiß. 5. Das ist der Mann, durch dessen Güte er gerettet wurde. 6. Welches geschäft Ihnen am meisten? Dieses oder jenes? Keines von Beiden. 7. Sind die zu lieben, deren Laster von Jetermann verabschiedet werden? 8. Wie viele Güte hat jener Knabe? 9. Er hat drei. 10. Wer verkauft hier gutes Brod? 11. Unser Bäcker verkauft sehr gutes Brod.

EXERCISE 68 (Vol. I., page 311).

1. There is very much fruit this year. 2. It is very beautiful weather to-day. 3. There are more poor people than rich. 4. It is really a pleasure to take a walk this morning. 5. Are there also ravenous beasts in Germany? 6. There are still many wolves in the mountains. 7. The hostile army is on its return (retreat). 8. Is there anything more beautiful than the rising of the sun? 9. It has snowed the whole

day. 10. Are you going with me this afternoon upon the ice? 11. No, it thaws already, and the ice may easily break in. 12. When it dawns I shall call for you for a walk. 13. It has snowed the whole of the day. 14. Does it rain already? 15. No, but it will soon begin to rain. 16. How long has it rained? 17. It rained till four o'clock. 18. Does it thunder? 19. Yes, it thunders and lightens, and I fear it will also hail. 20. Where were you when it snowed? 21. I took shelter in St. George's Chapel; for it not only snowed, but stormed and hailed. 22. I only tell you what I have heard.

EXERCISE 69 (Vol. I., page 311).

1. Es schien tiefen Morgen als ob es regnen wollte, aber nun sang das Wetter an schön zu werden. 2. Es ereignete sich, daß es regnete, gerade als die Schlacht begann; und es donnerte und hagelte den ganzen Tag hindurch. 3. Es hat diesen Winter geregnet, gehagelt, geschneit und gefroren. 4. So lange es regnet, kann ich nicht abreisen. 5. Es scheint, daß viele Fremde in diesem Gasthofe sind. 6. Es giebt viele Dinge, die wir nicht erklären können. 7. Sobald es tagt, werde ich bei Ihnen vorbeisuchen, um zu sehen und den Aufgang der Sonne zu sehen. 8. Gist es wohl etwas Erleichterung, als einem Feinde vergeben? 9. Wollen Sie morgen mit mir auf das Eis gehen? 10. Nein, ich fürchte, daß es schon thaut, und es würde gefährlich sein, es zu wagen. 11. Sobald der Wind sich legt, wird es regnen. 12. In jeder Gesellschaft giebt es mehr Dummköpfe als Bösewichte, und nicht Unwissende als Gelehrte.

EXERCISE 70 (Vol. I., page 323).

1. All exhalations and vapours which continually rise from the earth, collect in the atmosphere, and when they unite, rain, snow, mist, wind, and every other change of air results from them. 2. He who accustoms himself to work in his youth need not suffer want in his old age. 3. The Ludwig street in Munich is distinguished by a row of splendid palaces. 4. Those persons who praise themselves very often make themselves ridiculous. 5. The sons of Charles the Great were obliged to practise themselves in arms, in riding, and in swimming. 6. The daring diver ventures to plunge himself in the roaring whirlpool. 7. The envious (man) injures himself more than others. 8. Frederick the Great often stopped at Potsdam, in the palace of Sanssouci. 9. Goodness is its own reward. 10. The believer in affliction appears as a rock in the sea when the ocean billows rage about him. 11. The great blue arch which we call heaven, is an immeasurable space, in which the earth, sun, moon, and innumerable stars move. 12. The force with which the muscles contract and extend is very great. 13. Many people addict themselves so passionately to bad habits, that they consider them necessities of nature. 14. A child in the arms of its good parents is not afraid; so the man who has confidence in God. 15. The army collected together, and moved toward the river. 16. The enemy encamped around the town. 17. He distinguished himself from all others by his brave behaviour. 18. He is afraid of nobody. 19. He criticises my neighbour's words.

EXERCISE 71 (Vol. I., page 323).

1. Der Jüngling grüßte sich über den Verlust seiner Eltern. 2. Die Mutter war erfreut, als der Brief von meiner Schwester ihr vorgelesen wurde. 3. Sie tröstete sich mit dem Gedanken, daß sie bald antworten würde. 4. Werten Sie lange in Italien verweilen? Nein, es ist nicht mein Wille. 5. Ein eifriger Mann fürchtet nichts. 6. Die Elaven haben sich gegen die österreichische Regierung empört. 7. Die englischen Truppen zeichneten sich durch ihre Tapferkeit in der Schlacht bei Waterloo aus. 8. Derjenige, welcher sich über das Unglück eines Andern freut, verdient nicht den Beifall der Tugendhaften. 9. Derjenige, welcher sich argert, wenn ein Aelterer in seiner Gegenwart gelobt wird, ist ein Mensch, welcher nicht verdient, geliebt und gehört zu werden. 10. Derjenige, welcher sich freut, wenn sein Nach-bar geliebt wird, ist ein gutmüthiger Mensch.

RECREATIVE NATURAL HISTORY.

THE CRAB.

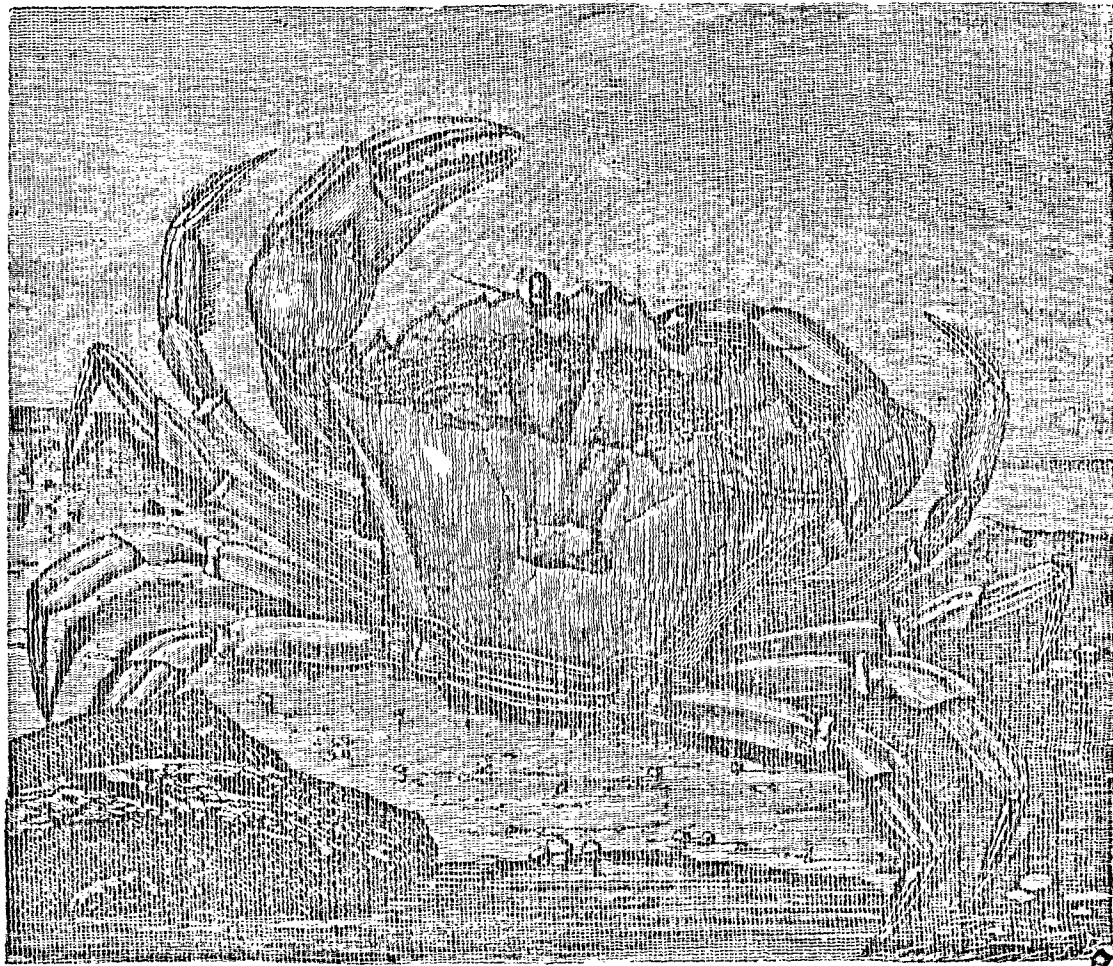
The word crab requires no definition, and the animal thus named is probably known to every reader. Whether the term be de-rived by abbreviation from the Latin *carabus* (crab, crab), of from a Saxon root signifying to bite or grip, is matter of debate. The latter origin is, however, the more probable. In this case one primary meaning can be traced through crab, the crus-tacean; crab, the apple, from its biting taste; and crab, a machine for lifting or gripping heavy weights. But this short word con-veys little notion of the animal's structure, and is therefore of no scientific value. What, then, does the reader say to the name *Decapod*, *brachyurus* crustacean? * To many this long

* *Decapod*, ten-footed; *brachyurus*, short-tailed.

name will at once suggest the peculiar structure of the crab; others may feel inclined to regard it as pedantic. But as the meaning of the designation is simply this, that the crab is a crustacean with a short tail and ten feet, it is an exact description of the animal.

Our notices must be limited to a few only of the more remarkable species, their singular habits and peculiar structure. The spider-crabs, so named from the great length of their legs, are found on many parts of the south, west, and east coasts of England. The large reddish, spine-backed spider-crab of Cornwall (*Maia squinado*) has sometimes the front legs fifteen inches long. Though little prized as food, and contemptuously

these fights, claws, limbs, and shells are torn, wrenched, and cracked, with a fury and energy to which a battle between two game-cocks is but play. When a large crab has seized a smaller, he tears open the shell, and scoops out the flesh of his living captive. Perhaps, while the conqueror is enjoying his feast, a still stronger crab will tear open the body of the victor, and feed upon him. The most singular fact is, that a crab, while thus being eaten, will actually continue to feed on the victim seized by himself. Here appears a total insensibility to suffering. A crab has been known to lose seven of its limbs in a fight, and immediately after to begin eating a captured mollusk, as if nothing particular had happened. These furious battles are probably



THE SHORE CRAB (*CARCINUS MAENAS*).

called "spiders" by the fishermen, this crustacean was highly honoured by the ancient Greeks, who deemed it a "rational animal," used it as a symbol of wisdom, and sculptured it on the statue of "Diana of the Ephesians." Still more was this genus honoured by receiving the name *Maia*, that of the mother of Mercury; and it is probable that the month of May was named from the same root. Thus the spine-backed spider-crab is not without a history.

The common edible crabs of the fish-shops (*Cancer pagurus*), though well known, require some notice. They are found on rocky parts of our coasts, the small animals inhabiting holes in the cliffs, but the larger and more experienced dwelling in deeper waters. When caught and kept alone in an aquarium, one of these crabs may become tame and quite familiar; but if placed with others of its race, a series of desperate battles will soon declare the degree to which the ferocity of the crab may extend. In

not so common when the crabs are in their natural state, as when pent up in a close marine tank.

The small red crab (*Carcinus maenas*) sold by the London costermongers is, of course, to be classed with the edible kind, though grouped with the portunians, or *paddling* crabs. It is easily found a little beneath the sand when the tide has gone down. One may be kept for several days in moist sand only; and if the captor will give his crab a mussel, he will receive his reward by observing the grave earnestness with which the crustacean scoops out the flesh with its hand-like claws. This crab is of a greenish tint when alive; the red colour of those on the stalls arises from the oxidation of the shell when boiled.

The voracity of the common crab renders it an easy prey to the fisherman, who has only to bait his wicker traps, called "crab-pots," or "stalkers," with useless or decayed fish, and

sink them in a suitable place, when the eager crustaceans will soon enter. Readers have, doubtless, noticed in the shops huge specimens of the edible crab; these fellows, brought up from deep waters, have sometimes weighed twelve pounds each.

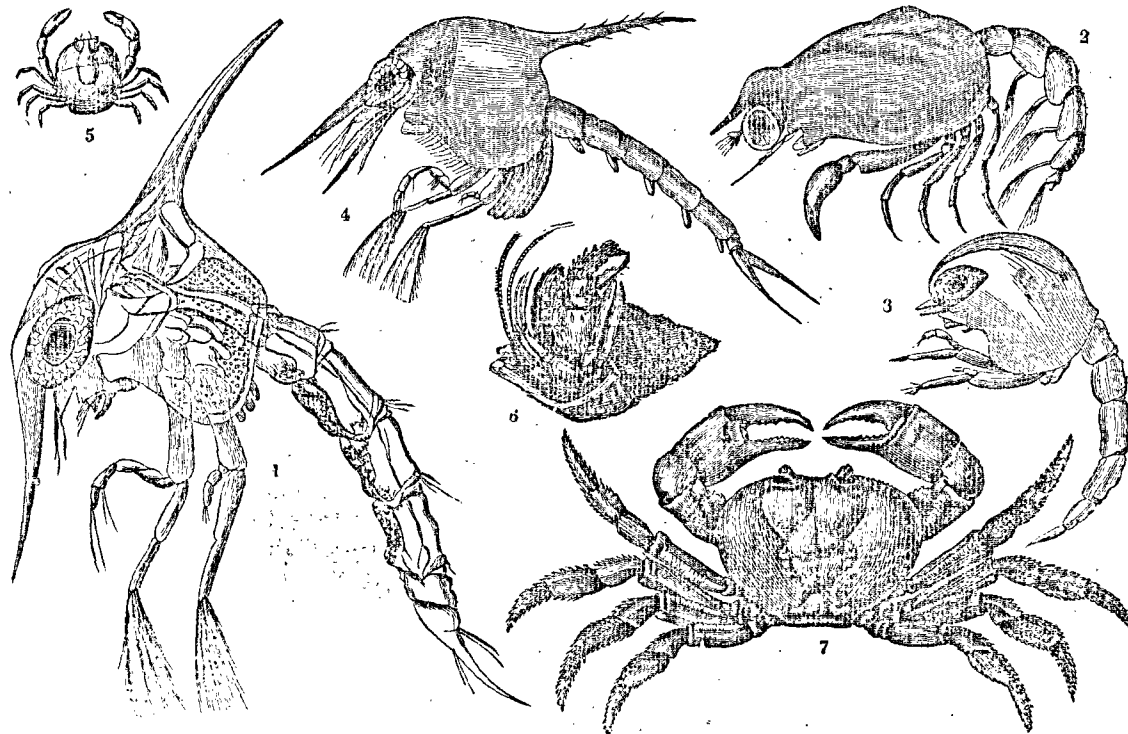
Perhaps the most remarkable of our British crustaceans is the hermit crab (*Pagurus Bernardus*). There is no mistaking this red and yellow tinted crab, as he runs along the sand, dragging with him the whelk or other shell which he has appropriated for his house. Most readers are aware that this family of crabs is without any shell on the hinder part of the body. Were this all, we might simply note the fact as a remarkable deviation from the usual structure of crustaceans. We should also infer that the animal's habits were suited to its peculiar formation, and that no sense of a deficiency in its covering would be felt by the creature. But this is not so; the crab does feel the absence of its protection, and remedies the want by seizing on the shells of other animals, and inserting the unde-

When the hermit grows too large for the shell first appropriated, another is sought, and, after repeated trials, is fitted to the body. Thus new homes are provided as required.

Of course we need not warn any reader not to place these crabs in an aquarium containing other marine creatures; the hermits will kill them all. If, however, a tank can be arranged for hermits only, the peace will probably be kept for some time, they having a wholesome respect for each other's pugnacity, and acting on the international principle, "If you wish peace, be ready for war."

The name "hermit" seems to have been given by those who fancied a resemblance between each crab in its shell and a lonely hermit in his cell. In the West Indies these crustaceans are called "soldiers," their thorax case suggesting the notion of a warrior's breastplate.

The habits of the pea crab (*Pinnotheres pisum*) are not less remarkable than those of the hermits, and demand a few sen-



1, 2. STAGES IN THE METAMORPHOSIS OF THE SHORE CRAB. 3, 4. STAGES IN THE METAMORPHOSIS OF THE SPIDER CRAB. 5. THE PEA CRAB. 6. THE HERMIT CRAB. 7. THE LAND CRAB.

fended part of its body into the appropriated asylum. If the crab finds the empty shell of a whelk, or any other of a suitable size and shape, the naked part of its body is so firmly fixed in the novel home that it is easily drawn after the animal. If no empty shell can be found, the fierce crab seizes a whelk, eats the victim, and appropriates its house. When one of these hermits is seen, the fore part of the body is alone visible, the rest being concealed in the cleverly adapted home. To enable the crab thus to crouch into a shell it was necessary to deprive it almost entirely of the two hinder pairs of legs, which are therefore only rudimentary limbs. The observer may wish to have a complete view of so strange a crustacean. Let him be cautious; the hermit is sharp in temper, and a pinch from its mandibles will not be soon forgotten. See how bravely the creature defends its house! Shrinking back as far as possible, it draws up the small claw, bars the entrance with the large one, and holds this in readiness to seize the enemy. Should the hermit at last be gripped without damage to fingers, it is even then a question whether its body will not be torn asunder in the endeavour to drag it out. This tenacity of hold arises from a peculiar grasping apparatus on the tail.

These pinnotherians are sometimes not above one-tenth of an inch long, are of a pale-red colour, and inhabit the shells of *living mussels*. The common edible mussel may often be found with one of these small pea crabs dwelling very comfortably inside the shell, without apparently giving any annoyance to the mussel. The softness of their carapace compels these small crustaceans to find so strange a shelter in the homes of living mollusks. What service the crab renders the mussel is debated, though the old naturalists were very clear upon the matter, holding that the tenant gave warning to its protector of approaching foes, the mussel then closed its shell, and both were safe. "Thus," remarks one writer, "the little crab pays a good rent, by saving the life of his landlady." Sometimes a whole family of pea crabs will be found thus living with their guardian in the utmost harmony. Some naturalists, however, hint that the mussel would gladly eject the intruders if it were possible. Cockles, oysters, and other mollusks, are also patronised by the pea crabs.

* *Mussel protectors*; so named from the notion that these small crabs guarded the pinna, or mussel, from the cuttle-fish.

The land crabs (*Gecarcinus**) present us with the remarkable fact of terrestrial animals breathing by gills. Most fish die if out of the water for a few minutes, but a long submersion in the sea would actually kill these crabs. The *gecarcinians* visit the shore once a year only, for the purpose of depositing their eggs in the water. During the rest of the year these animals live in moist holes, in woods and rocky crevices, hiding in the day, and coming out to feed at night. The land crabs have a peculiar apparatus near the gills for holding water, so that the branchiae are always kept moist. The species of *gecarcinians* inhabiting the South Sea Islands, and feeding upon cocoa-nuts, are said to visit the sea-shore every night to dip their gills in the water.

The mountain crab of Jamaica is declared by epicures to make a most delicious stew when caught at the proper time and seasoned with lime juice.

We must now make a few remarks on the general structure and physiology of these crustacea. Though crabs are classed with decapods, they have, in strictness, but eight feet, the front pair of limbs being mandibles, which serve as hands, and are not intended to aid progression. The well-known sideways motion of crabs is a necessary result of the peculiar manner in which the joints of the legs are hinged one to the other. Lost limbs are usually restored at moulting time, when the crab throws off its old shell. After a claw has been torn away, the blood vessels and nerves shrink at the point of separation, and from the hollow thus formed the new limb afterwards grows. A crab which had lost seven legs in battle, recovered them all about three months after, when the shell was cast. The new limbs were perfect in all respects, but somewhat smaller than the former set.

These repeated castings of so hard a shell, and the extrication of all the complex limbs from their stony covering, are not the least remarkable phenomena in a crab's life. When the animal ceases to increase, these changes doubtless cease; but during growth several such unclothings must occur. Crabs have been taken covered with oysters of seven years' growth, a clear proof that during the whole of that period the shell had not been cast. These crabs had, of course, ceased growing. How a creature of so complex a form withdraws its body from the tightly-fitting shell, leaving the latter, to all appearance, entire, is a puzzling problem. So completely does the rejected covering retain its form that an observer might easily mistake it for another but smaller crab than its late owner. We say smaller, because the animal after moulting is always larger than the coat it has just put off.

The operation is by no means a pleasant one, if we may judge by the symptoms of decided "illness" shown by the crustacean. It ceases to eat, wriggles about, rubs against the rocks, and acts like a creature "out of sorts." A thin skin is prepared under the shell before this is thrown off, and the under coat soon hardens into a new covering. If we take up one of the shells soon after the moult, we may, with close inspection, generally detect a crack where the crust was split when the body was being drawn out.

It has been lately ascertained that the crab undergoes a complete metamorphosis, all the changes having been traced from the egg to the perfect crab. The first form of the young crustacean is utterly unlike the parent, and was formerly a puzzle to zoologists, who, while they named it *Zoea*, could only guess at its nature. These creatures, after casting their shells, pass into the second state, in which they bear some resemblance to a shrimp. From this condition they at length emerge as perfect crabs. This metamorphosis has now been proved to occur in no less than seventeen genera of short-tailed decapods. The first hint of these transmutations was given by Slabber, a Dutch naturalist, a hundred years ago; and the truth was gradually proved by Mr. Vaughan Thompson, Mr. Couch, and M. Milne-Edwards.

The crab, of course, breathes by gills or branchiae,† as they are often called. These occupy two cavities in the chest, the water being admitted to them through a slit in the side of the thorax, and ejected by an opening near the mouth. The animal is able to regulate the outflow of water from the gills by a movable plate which, turning on a pivot, can be opened or shut at pleasure. By raising the carapace a little, the breath-

ing apparatus, consisting of thousands of fine filaments, may be seen in action.

The crab's heart is placed just under the carapace, and is simply a strong muscular pouch or ventricle, from which the blood is sent over the body, and also to the gills, resembling in this respect the action of the human heart. The blood is mostly colourless, though sometimes a bluish tint may be noticed.

The nervous system of the crab consists of numerous ganglia (nervous centres) placed in the abdomen and chest, from which the fine nerve-threads radiate through the body. The most important of these nerves are beautifully exhibited in the hermit crabs dissected by Professor Owen, and now to be seen in the museum of the College of Surgeons.

The eyes are compound; each consisting of numerous six-sided tubes, every one of which forms a distinct eye or eyeclet. These organs being placed on short tube-like bodies, retractile in some species, all such crustaceans are called "stalk-eyed."

The crab's ears are supposed to be concealed under a plate, on the lower part of the second antenna. If this plate be removed, a fine membrane will be seen, covering a cavity filled with a fluid, in which the nerve of hearing is visible.

The carapace, or shelly covering of the crab, corresponds to the epidermis, or outer skin, in man, but forms, in reality, the skeleton of the crustacea. It generally consists of about twenty-one flat shelly rings, and is formed of carbonate and phosphate of lime. The peculiar colouring matter is produced by the inner skin, or *corium*, and becomes, under the action of boiling water, of a reddish hue. The lime, phosphorus, carbon, and other elements forming the shell, are secreted by the animals from the sea water.

The crab has found a place in heraldry, several old families having adopted this crustacean among their insignia; and even that warlike and chivalrous king, Francis I. of France, did on one occasion, at least, introduce the animal into his shield. This, however, is said to have been a satirical allusion to the hesitating movements of the English army in France, under the Duke of Suffolk, in 1523.

All crabs discharge a most useful duty, being in fact the scavengers of the sea, consuming the dead animal matter which would otherwise do much to corrupt the waters along the coasts. Thus even the voracity of the crab promotes the well-being of the natural world, and consequently benefits the human race.

LESSONS IN GEOGRAPHY.—XXVII.

We now resume and continue the table of latitudes and longitudes of places in the Continent of Europe, commenced in our last lesson (see page 389, Vol. II.).

TABLE OF LATITUDES AND LONGITUDES OF PLACES IN EUROPE.

Name of Place.	Country, etc.	Latitude.	Longitude
Cefalu	Sicily	38° 1' N.	14° 3' E.
Cephalonia (I.)	Mediterranean	38 15	20 33 E.
Cerigo (I.)	Mediterranean	36 15	23 0 E.
Chalons-sur-Marne	France	48 59	4 20 E.
Chalons-sur-Saône	France	48 47	4 52 E.
Charkoff, or Kharkov	Russia	49 58	36 19 E.
Chartres	France	48 26	1 29 E.
Chelmsford	England	50 44	0 28 E.
Cheltenham	England	51 55	2 5 W.
Cherbourg	France	49 38	1 37 W.
Cherson, or Kherson	Russia	46 39	32 32 E.
Chester	England	53 12	2 54 W.
Chichester	England	50 51	0 47 W.
Christiania	Norway	59 54	10 48 E.
Christiansand	Norway	58 8	7 55 E.
Christianstad	Sweden	56 1	14 9 E.
Christiansund	Norway	63 7	7 46 E.
Christinestad	Russia	62 11	21 27 E.
Cilli	Austria	46 14	15 16 E.
Civitavecchia	Italy	42 6	11 48 E.
Clausnitz	Saxony	50 44	13 29 E.
Clear (Cape)	Ireland	51 25	9 32 W.
Clermont	France	49 5	5 3 E.
Cleve	Prussia	51 47	6 9 E.
Coblenz	Prussia	50 21	7 35 E.
Coburg	Germany	50 15	12 59 E.

* The Greek for land crab.

† The Greek for gills.

LESSONS IN GEOGRAPHY.

Name of Place.	Country, etc.	Latitude.	Longitude.	Name of Place.	Country, etc.	Latitude.	Longitude.
Coimbra	Portugal	40° 13' N.	8° 26' W.	Gibraltar	Spain	36° 8' N.	5° 21' W.
Colchester	England	51 53	0 54 E.	Girgenti	Sicily	37 18	13 23 E.
Cologne	Prussia	50 56	6 59 E.	Glasgow	Scotland	55 51	4 16 W.
Como	Italy	45 48	9 3 E.	Glastonbury	England	51 9	2 33 W.
Constance	Baden	47 39	9 11 E.	Gloucester	England	51 52	2 15 W.
Constantinople	Turkey	41 0	28 59 E.	Gluchol	Russia	57 33	28 56 E.
Copenhagen	Denmark	55 40	12 35 E.	Gluckstadt	Prussia	58 47	9 24 E.
Corfu (I.)	Mediterranean Sea	39 37	19 55 E.	Gotha	Germany	50 57	10 42 E.
Corinth	Greece	37 55	23 53 E.	Gothland (I.)	Baltic Sea	57 30	18 30 E.
Cork	Ireland	51 53	8 23 W.	Gottenborg	Sweden	57 39	11 59 E.
Coron, or Messenia (Gulf of)	Greece	36 55	22 5 E.	Gottingen	Germany	51 32	9 56 E.
Courtray	Belgium	50 55	4 48 E.	Gouda	The Netherlands	52 1	4 42 E.
Contances	France	49 2	1 26 W.	Gradisca	Austria	45 54	13 30 E.
Coventry	England	52 26	1 30 W.	Graz	Austria	47 4	15 26 E.
Cracow	Gallicia (Austria)	50 4	19 56 E.	Gravelines	France	51 0	2 6 E.
Cremona	Italy	45 8	10 1 E.	Greenwich	England	51 28	0 0
Cronstadt	Russia	60 0	29 46 E.	Grenoble	France	45 12	5 42 E.
Cuxhaven	Germany	53 52	8 41 E.	Grodno	Russia	53 41	23 49 E.
Dago (I.)	Baltic Sea	58 50	22 35 E.	Guastalla	Italy	44 55	10 39 E.
Danzig, or Danzig	Prussia	54 10	18 30 E.	Gueders, or Geldern	Prussia	51 31	6 19 E.
Darmstadt	Hesse-Darmstadt	49 52	8 38 E.	Haarlem	The Netherlands	52 23	4 38 E.
Daventry	England	52 16	1 10 W.	Hague	The Netherlands	52 3	4 18 E.
Deal Castle	England	51 13	1 24 E.	Halberstadt	Prussia	51 54	11 3 E.
Delft	The Netherlands	52 1	4 22 E.	Halle	Prussia	51 29	11 59 E.
Derby	England	52 56	1 29 W.	Halmstad	Sweden	56 39	12 49 E.
Dieppe	France	49 56	1 5 E.	Hamburg	Germany	53 33	10 0 E.
Dijon	France	47 21	5 2 E.	Hammerfest	Norway	70 38	23 39 E.
Dixmade	Belgium	51 2	2 51 E.	Hanover	Prussia	52 23	9 42 E.
Dorchester	England	51 43	2 27 W.	Harlingen	The Netherlands	53 10	5 24 E.
Dordrecht	The Netherlands	51 49	4 41 E.	Hartlepool	England	54 42	1 11 W.
Dorpat	Russia	58 17	26 47 E.	Havre	France	49 29	0 6 E.
Dover Castle	England	51 7	1 18 E.	Helsingborg	Sweden	56 3	12 42 E.
Dresden	Saxony	51 3	13 45 E.	Helsingfors	Russia	60 14	24 57 E.
Drontheim, or Trondhjem	Norway	63 25	10 23 E.	Hellevoetsluis	The Netherlands	51 50	4 7 E.
Dublin	Ireland	53 21	6 16 W.	Heraclea	Turkey	41 0	27 57 E.
Dundee	Scotland	56 28	2 58 W.	Herenthals	Belgium	51 11	4 51 E.
Dunkirk	France	51 7	2 39 E.	Hermösand	Sweden	62 35	17 49 E.
Dumazoo	Turkey	41 16	19 26 E.	Holar	Iceland	65 34	20 35 W.
Durham	England	54 47	1 35 W.	Holy I.	England	55 40	1 47 W.
Dusseldorf	Germany	51 13	6 46 E.	Holyhead	Wales	52 18	4 39 W.
Eddystone Lighth.	English Channel	50 11	4 16 W.	Horsham	England	51 3	0 20 W.
Edinburgh	Scotland	55 57	3 11 W.	Huntingdon	England	52 20	0 11 W.
Eisenach	Germany	50 59	10 19 E.	Hyères	France	43 7	6 5 E.
Elba (I.)	Mediterranean Sea	42 46	10 15 E.	Iglau	Austria	49 23	15 35 E.
Elbing	Prussia	54 10	19 25 E.	Ilchester	England	51 0	2 41 W.
Elisnora	Denmark	56 2	12 36 E.	Ingolstadt	Bavaria	48 47	11 25 E.
Ely	England	52 24	0 15 E.	Innsbruck	Austria	47 17	11 24 E.
Emden	Prussia	53 22	7 12 E.	Ismail	Turkey	45 22	23 50 E.
Enkhizen	The Netherlands	52 42	6 17 E.	Ivica (I.)	Mediterranean Sea	38 54	1 26 E.
Erfurt	Prussia	50 58	11 0 E.	Jaroslav	Russia	57 36	40 12 E.
Escorial, The	Spain	40 46	4 11 W.	Jassy	Moldavia	47 10	27 37 E.
Evreux	France	49 0	1 9 E.	Jersey (I.)	English Channel	49 13	2 7 W.
Exeter	England	50 43	3 31 W.	Johannisberg	Prussia	53 37	21 49 E.
Faro	Portugal	37 0	7 52 W.	Kaluga	Russia	54 32	36 18 E.
Faro Islands	Atlantic Ocean	62 0	7 0 W.	Kaminiets	Russia	48 42	26 33 E.
Ferrara	Italy	44 50	11 37 E.	Kasan	Russia	55 47	49 3 E.
Ferrol	Spain	43 29	8 15 W.	Kaskoe	Russia	62 17	21 19 E.
Finisterra (Cape)	Spain	42 53	9 16 W.	Kertch	Crimæa	45 23	36 29 E.
Fiume	Austria	45 19	14 27 E.	Kidwelly	Wales	51 45	4 18 W.
Flensburg	Denmark	54 46	9 26 E.	Kiel	Prussia	54 19	10 8 E.
Florence	Italy	43 47	11 14 E.	Kiev	Russia	50 27	30 34 E.
Flushing	The Netherlands	51 26	3 35 E.	Klansfurt	Ireland	51 42	8 32 W.
Folkestone	England	51 5	1 11 E.	Klin	Austria	46 37	14 19 E.
Fontenoy	Belgium	50 24	3 27 E.	Kola	Russia	56 22	36 48 E.
Forceland N.	England	51 23	1 27 W.	Königsberg	Russia	54 42	33 2 E.
Foreland S.	England	51 9	1 23 E.	Koslov	Russia	54 42	20 30 E.
Frankfurt-on-the-Maine	Prussia	50 7	9 41 E.	Kostroma	Russia	45 11	33 22 E.
Frankfurt-on-the-Oder	Prussia	52 21	14 32 E.	Kragero	Norway	59 52	9 29 E.
Frejus	France	43 26	6 45 E.	Krems	Austria	48 25	15 36 E.
Fulda	Prussia	50 32	9 40 E.	Kursk	Russia	51 44	36 13 E.
Gall, St.	Switzerland	46 31	8 49 E.	Lagos	Portugal	37 10	8 37 W.
Gallipoli	Turkey	40 25	26 39 E.	Lancaster	England	54 3	2 48 W.
Gap	France	44 34	6 4 E.	Landsberg	Bavaria	48 4	10 51 E.
Gata, Cape de	Spain	36 43	2 12 W.	Landscrona	Sweden	55 52	12 49 E.
Gede	Sweden	60 38	17 10 E.	Langres	France	47 53	5 20 E.
Gedva	Switzerland	46 12	6 9 E.	Laon	France	49 34	3 36 E.
Genoa	Italy	44 23	8 55 E.	Laybach	Austria	46 3	14 31 E.
Gent, or Gand	Belgium	51 2	3 44 E.	Launceston	England	50 48	4 21 W.
				Leasowes	England	53 27	1 59 W.
				Leghorn	Italy	43 33	10 18 E.

you may observe) the commands of your father. 20. I feared I was displeasing you. 21. Take care to improve the morals and to exercise the body of the boy. 22. I feared that an enemy was injuring me. 23. The boy feared that his mother was silent. 24. I took care to improve (that I might improve) the morals and to exercise the body of the boy. 25. I took care that you should improve the morals and (that you should) exercise the body of the boy. 26. I took care that the teacher should improve the morals and exercise the body of the boy. 27. I fear that you will (may) not come. 28. The husband fears that his wife will (may) die. 29. The teacher feared that the scholar would not obey his words. 30. The bad boy fears that the teacher will come.

EXERCISE 93.—ENGLISH-LATIN.

1. Ille me moneretis. 2. Illi regem monerant. 3. Ego vos monerem. 4. Vos me moneretis. 5. Illi puerum monuerunt. 6. Tu mulierem monerabas. 7. Ego preceptorem monerem. 8. Tace. 9. Tace. 10. Tace. 11. Mulier repente tacuit. 12. Cura ntemendes. 13. Cura ut civium mores emendes. 14. Timor ne tibi displiceat. 15. Pueri timebant ne patri displicerent. 16. Omnibus placet. 17. Bonus malis displiceat. 18. Cur taces? 19. Metuunt ne Caesar patriam vincat. 20. Bonas sorores timeant ut fratres valeant. 21. Valesne? 22. Timeant vales. 23. Si corpus exercearis valabis. 24. Mater timet ut mihi aditus in caelum pateat.

LESSONS IN ALGEBRA.—I.

DEFINITIONS.

ART. 1.—ALGEBRA is a general method of solving problems, and of investigating the relations of quantities by means of letters and signs.

The following will afford illustrations of this method of arriving at the solutions of problems by the use of signs and letters instead of figures as in arithmetic.

PROBLEM I.—Suppose that a man divided 72 pounds among his three sons in the following manner:—To A he gave a certain number of pounds; to B he gave three times as many as to A; and to C he gave the remainder, which was half as many pounds as A and B received. How many pounds did the donor give to each?

To solve this problem arithmetically, the pupil would reason thus:—A had a certain part, that is one share; B received three times as much, or three shares; but C had half as much as A and B; hence he must have received two shares. By adding their respective shares, the sum is six shares, which, by the conditions of the question, is equal to 72 pounds. If, then, 6 shares are equal to 72 pounds, 1 share is equal to $\frac{1}{6}$ of 72, namely, 12 pounds, which is A's share. B had three times as many, namely, 36 pounds; and C half as many pounds as both, namely, 24 pounds.

Now, to solve the same problem by algebra, he would use letters and signs, thus:

Let x represent A's share; then by the conditions, x multiplied by 3, or $x \times 3$ (when $\times$, the sign of multiplication, is used instead of the words "multiplied by"), will represent B's share, and

$4x$, the sum of the shares of A and B divided by 2, or $4x \div 2$ (when $\div$, the sign of division, is used instead of the words "divided by"), will represent C's share.

Now, $x \times 3$ may be written $3x$, and $4x \div 2$ may be written $2x$; so then adding together the several shares of A, B, and C, namely, x , $3x$, and $2x$, and putting $+$, the sign of addition, between them, we get $x + 3x + 2x$, which is equal to $6x$; or using $=$, the sign of equality, for the words "is equal to," we get $x + 3x + 2x = 6x$. Then $6x = 72$, for the whole is equal to all its parts; and $1x = 12$ pounds, A's share; $3x = 36$ pounds, B's share; and $2x = 24$ pounds, C's share.

Proof.—Add together the number of pounds received by each, and the sum will be equal to 72 pounds, the amount divided between A, B, and C.

In this algebraic solution it will be observed: First, that we represent the number of pounds which A received by x . Second, to obtain B's share, we must multiply A's share by 3. This multiplication is represented by two lines crossing each other like a capital X. Third, to find C's share, we must take half the sum of A's and B's share. This division is denoted by a line between two dots. Fourth, the addition of their respective shares is denoted by another cross formed by an horizontal and a perpendicular line. Take another example:—

PROBLEM II.—A boy wishes to lay out 96 pence for peaches and oranges, and wants to get an equal number of each. He

finds that he must give 2 pence for a peach, and 4 pence for an orange. How many can he buy of each?

Let x denote the number of each. Now, since the price of one peach is 2 pence, the price of x peaches will be $x \times 2$ pence, or $2x$ pence. For the same reason, $x \times 4$, or $4x$ pence, will denote the price of x oranges. Then will $2x + 4x$, or $6x$, be equal to 96 pence by the conditions of that question, and $1x$ or x (for when 1 is the co-efficient of a number [See Art. 16 below] it is always understood, and never expressed) is equal to $\frac{1}{6}$ of 96 pence, namely, 16 pence, and 16 is therefore the number he bought of each.

2. Quantities in algebra are generally expressed by letters, as in the preceding problems. Thus b may be put for 2 or 15, or any other number which we may wish to express. It must not be inferred, however, that the letter used has no determinate value. Its value is fixed for the occasion or problem on which it is employed, and remains unaltered throughout the solution of that problem. But on a different occasion, or in another problem, the same letter may be put for any other number. Thus, in Problem I., x was put for A's share of the money. Its value was 12 pounds, and remained fixed through the operation. In Problem II., x was put for the number of each kind of fruit. Its value was 16, and it remained so throughout the whole of the calculation.

3. By the term quantity, we mean anything that can be multiplied, divided, or measured. Thus, length, weight, time, number, etc., are called quantities.

4. The first letters of the alphabet, a, b, c , etc., are used to express known quantities; and the last letters, x, y, z , etc., those which are unknown.

5. Known quantities are those whose values are given, or may be easily inferred from the conditions of the problem under consideration.

6. Unknown quantities are those whose values are not given, but required.

7. Sometimes, however, the given quantities, instead of being expressed by letters, are given in figures.

8. Besides letters and figures, it will also be seen that we use certain signs or characters in algebra to indicate the relations of the quantities, or the operations which are to be performed with them, instead of writing out these relations and operations in words. Among these are the signs of addition (+), subtraction (−), equality (=), etc.

9. Addition is represented by two lines (+), one horizontal, the other perpendicular, forming a cross, which is called plus. It signifies "more," or "added to." Thus $a + b$ signifies that b is to be added to a . It is read a plus b , or a added to b , or a and b .

10. Subtraction is represented by a short horizontal line (−) which is called minus. Thus, $a - b$ signifies that b is to be "subtracted" from a ; and the expression (see Art. 22 below) is read a minus b , or a less b .

11. The sign $+$ is prefixed to quantities which are considered as positive or affirmative; and the sign $-$ to those which are supposed to be negative. For the nature of this distinction, see Articles 36 and 37.

12. The sign is generally omitted before the first or leading quantity, unless it is negative; then it must always be written. When no sign is prefixed to a quantity, $+$ is always understood. Thus $a + b$ is the same as $+$ $a + b$.

13. Sometimes both $+$ and $-$ (the latter being put under the former, $\pm$) are prefixed to the same letter. The sign is then said to be ambiguous. Thus $a \pm b$ signifies, that in certain cases, comprehended in a general solution, b is to be added to a , and in other cases subtracted from it.

Observation.—When all the signs are plus, or all minus, they are said to be alike; when some are plus and others minus, they are called unlike.

14. The equality of two quantities, or sets of quantities, is expressed by two parallel lines, $=$. Thus $a + b = d$ signifies that a and b together are equal to d . So $8 + 4 = 16 - 4 = 10 + 2 = 7 + 2 + 3$.

15. When the first of the two quantities compared is greater than the other, the character $>$ is placed between them. Thus $a > b$ signifies that a is greater than b .

If the first is less than the other, the character $<$ is used; as $a < b$, namely, a is less than b . In both cases, the quantity towards which the character opens is greater than the other.

16. A numeral figure is often prefixed to a letter. This is called a co-efficient. It shows how often the quantity expressed by the letter is to be taken. Thus $2b$ signifies twice b ; and $9b$, 9 times b , or 9 multiplied into b .

The co-efficient may be either a whole number or a fraction. Thus $\frac{2}{3}b$ is two-thirds of b . When the co-efficient is not expressed, 1 is always to be understood. Thus a is the same as $1a$, that is to say, once a , or one times.

17. The co-efficient may also be a letter, as well as a figure. In the quantity mb , m may be considered the co-efficient of b ; because b is to be taken as many times as there are units in m . If m stands for 6, then mb is six times b . In $3abc$, 3 may be considered as the co-efficient of abc ; $3a$ the co-efficient of bc ; or $3ab$ the co-efficient of c .

18. A simple quantity is either a single letter or number, or several letters connected together without the signs $+$ or $-$. Thus a, ab, abd , and $8b$, are each of them simple quantities.

19. A compound quantity consists of a number of simple quantities connected by the sign $+$ or $-$. Thus $a + b, d - y, b - d + 3h$, are each compound quantities. The members of which each is composed are called terms.

20. A simple term is called a monomial; thus, $a, b, -c$ are monomials. If there are two terms in a compound quantity, it is called a binomial; thus $a + b$ and $a - b$ are binomials. The latter term ($a - b$) is also called a residual quantity, because it expresses the difference of two quantities, or the remainder after one is taken from the other. A compound quantity, consisting of three terms, is sometimes called a trinomial; one of four terms, a quadrinomial. A quantity consisting of several terms is, however, generally called a polynomial.

21. When the several members of a compound quantity are to be subjected to the same operation, they are connected by a line called a vinculum (—), or by a parenthesis (). Thus $a - b + c$, or $a - (b + c)$, shows that the sum of b and c is to be subtracted from a . But $a - b + c$ signifies that b is to be subtracted from a , and c is to be added to the result.

22. A single letter, or a number of letters, representing any quantities with their relations, is called an algebraic expression or formula. Thus $a + b + 3d$ is an algebraic expression.

23. Multiplication is usually denoted by two oblique lines crossing each other, thus $\times$; hence, $a \times b$ is a multiplied into b ; and 6×3 is 6 times 3, or 6 multiplied into 3. Sometimes a point is used to indicate multiplication: thus, $a . b$ is the same as $a \times b$. But the sign of multiplication is more commonly omitted between simple quantities, and the letters are connected together in the form of a word or syllable: thus, ab is the same as $a . b$ or $a \times b$; and $bcde$ is the same as $b \times c \times d \times e$. When a compound quantity is to be multiplied, a vinculum or parenthesis is used, as in the case of subtraction. Thus the sum of a and b multiplied into the sum of c and d , is $(a + b) \times (c + d)$. And $(6 + 2) \times 5$ is 8×5 , or 40. But $6 + (2 \times 5)$ is $6 + 10$, or 16. When the marks of parenthesis are used, the sign of multiplication is frequently omitted. Thus $(x + y)(x - y)$ is $(x + y) \times (x - y)$.

24. When two or more quantities are multiplied together, each of them is called a factor. In the product ab , a is a factor, and $8b$ is b . In the product $x(u + m)$, x is one of the factors, and $(u + m)$ the other. Hence every co-efficient may be considered as a factor (Art. 17). In the product $3y$, 3 is a factor as well as y .

25. A quantity is said to be resolved into factors, when any factors are taken which, being multiplied together, will produce the given quantity. Thus $3ab$ may be resolved into the two factors $3a$ and b , because $3a \times b$ is $3ab$. And $5amm$ may be resolved into the three factors $5a$, and m , and n . And 48 may be resolved into the two factors 2×24 , or 3×16 , or 4×12 , or 6×8 ; or into the three factors $2 \times 3 \times 8$, or $4 \times 6 \times 2$, etc.

26. Division is expressed in two ways: (1.) By an horizontal line between two dots $\div$, which shows that the quantity preceding it is to be divided by that which follows. Thus $a \div c$, is a divided by c .

(2.) Division is more commonly expressed in the form of a fraction, putting the dividend in the place of the numerator, and the divisor in that of the denominator. Thus $\frac{a}{b}$ is a divided by b .

READINGS IN GERMAN.—I.

INTRODUCTION.

THE object of learning a modern language is not simply, as in the case of one that is no longer spoken, to be able to read and write, but also to speak it. For this purpose it is obviously necessary to acquire a knowledge of the pronunciation as well as the meaning of the words. Hence we are not surprised at having received many applications from the readers of our lessons in German for some instruction on this subject; and it is our intention to publish in the pages of the POPULAR EDUCATOR a series of German Reading Lessons expressly prepared with a view to teach the proper pronunciation of the language. These lessons will be found much better adapted to answer the purpose than any mere collection of rules, however carefully drawn up, and however clearly expressed. In no case is the principle, that example is better than precept, more applicable than in that of pronunciation, a knowledge of which can only be acquired by frequent exemplification. We have no hesitation in saying that the study of our lessons will enable the reader to pronounce German, if not with absolute perfection, at least so as to be easily understood by a native, which is, after all, the only practical object in view.

It is proper to observe, that whilst the lessons are especially intended to teach pronunciation, they are also calculated to be very useful to our readers as exercises in translation, being easy in construction, simple in style, rich in words, and adapted in substance to persons of all ages. A vocabulary will be appended to each lesson, containing an explanation of the meaning of every word in it which has not been previously explained. As few words will be explained more than once in the whole course of the vocabularies, it will be necessary for the learner to study each with great care on its first occurrence, that he may avoid the inconvenience of having to look through preceding pages for the meaning.

DIRECTIONS FOR THE USE OF THE INTERLINEAR PRONUNCIATION.

Pronounce every syllable as in English.

To make a vowel long which otherwise would be short, or might be either short or long, an apostrophe has been placed immediately after that vowel. Thus *vol* will rhyme with *doll*, but *vo'* will rhyme with *whole*.

To make a vowel short which otherwise would be long, or might be either long or short, the short sign or breve has been placed over that vowel. Thus *mild* will rhyme with *wild*, but *mild* will rhyme with *build*. *Boot* will rhyme with *root*, but *bööt* will rhyme with *put*.

ah is long, and sounded as in *father*; *a* is short, and sounded as in *castle*.

ey is to be pronounced as in *obey*.

ai, representing the short sound of *e*, when unaccented and terminating a syllable, should be pronounced like *ey* in the noun *sur-vey*. The letters *ey* could not well be used for this sound, as they have generally the sound of *ee* when unaccented.

ö has no corresponding sound in English; place the organs as if to pronounce *o* long; keep them exactly in this position, and they try to pronounce the German *e* or English *a*. For the short sound of this vowel place the organs again as if to pronounce *o*, and without changing, try to pronounce *ef*, *el*, *ek*, *em*, *en*, *ep*, *er*, *ess*, *et*, and you will utter the sound required. The sound which comes nearest to it is the *e* in *her*.

ü has no parallel in English. Pronounce *oo* in *ooze*, firmly maintain this position, and try to pronounce long *e* in *cel*; the sound uttered will be the one required. For the short sound, place the organs in a similar position, and without changing it try to say *if*, *il*, *ick*, *im*, *in*, *ip*, *ir*, *iss*, *it*. For those who have studied French it may be well to remark that the German *ü* has the same sound as the French *u*.

ou is always to be sounded as in *out*, *our*.

gh before *e* and *i* must be pronounced like *g* in *get*, *gimlet*.

ch has different sounds, according to its position in the word.

In the interlinear pronunciation we shall denote it by—
q, when it is pronounced like an aspirated *k*, or like the

SECTION XCII.—SOME PECULIAR IDIOMS.

1. **Avancer, retarder**, correspond to the English verbs to gain, to lose, to put forward, to put back, in speaking of a watch or clock, &c. The preposition *de* is placed before the word expressing the variation:—

Ma montre retarde d'une demi-heure. *My watch is half an hour too slow.*
La maïenne avance d'un quart d'heure. *Mine is a quarter of an hour too fast.*
J'ai avancé cette pendule d'une demi-heure. *I set that clock half an hour forward.*
Retardez votre montre de cinq minutes. *Put your watch five minutes back.*

2. **Mettre** [4. ir.] à l'heure, means to set right, to put right, to set:—

Mettez cette montre à l'heure. *Set that watch right.*

3. **S'accorder**, to agree, is said also of clocks, watches, &c.

MISCELLANEOUS EXAMPLES.

Votre montre va-t-elle bien? *Does your watch go well?*
Elle retarde d'une demi-heure par jour. *It loses half an hour a day.*
Elle avance d'un quart d'heure par semaine. *It gains a quarter of an hour a week.*
De combien avance-t-elle? *How much has it gained?*
Je viens de mettre ma montre à l'heure. *I have just set my watch right.*
Si votre montre retarde, pourquoi ne l'avancez-vous pas? *If your watch loses, why do you not set it forward?*
Ma pendule avance; je viens de la retarder. *My clock gains; I have just set it back.*
Quelle heure est-il à votre montre? *What o'clock is it by your watch?*
Ma pendule sonne les heures et les demies. *My clock strikes the hour and the half hour.*
J'ai oublié de la monter (or remonter). *I have forgotten to wind it up.*
Votre montre est dérangée. *Your watch is out of order.*
Il faudra la faire rettyer. *It will be necessary to have it cleaned.*
La sonnerie en est dérangée. *The striking part is out of order.*
Votre pendule et ma montre ne s'accordent pas. *Your clock and my watch do not agree.*
Les pendules à ressort vont mieux que les pendules à poids. *Spring-clocks go better than weight-clocks.*
L'horloge a sonné deux heures. *The clock has struck two.*

EXERCISE 179.

Aiguille, *f.*, hand. *Droit, e*, straight. *Ressort (grand), m.*, main-spring.
Arrêter (s'), *1. ref. to stop.* *Fêlé, e*, cracked. *Juste, right, correct.* *Matin, m.*, morning. *Matin, m.*, morning.
Balancier, *m.*, pendulum. *Juste, right, correct.* *Secundes (montre à),* watch with a second-hand.
Boîte, *f.*, watch-case. *Perfection, f.*, perfection. *hand.*
Cadran, *m.*, face, dial. *Plat, e*, flat, thin. *Timbre, m.*, bell of a clock.
Casser, *1. to break.* *Régler, 1.*, to regulate. *clock.*
Double, double. *Répétition (montre à),* Vito, quick, quickly. *f. repeater.*

1. N'avez-vous pas une montre à répétition? 2. J'ai une montre d'or à double boîte. 3. Va-t-elle mieux que la mienne? 4. Elle ne va pas bien, elle retarde d'une heure par jour. 5. Est-ce une montre à secondes? 6. C'est une montre à secondes et à cadran d'or. 7. Votre pendule ne sonne-t-elle pas? 8. Elle ne sonne plus, le timbre en est cassé. 9. Pourquoi ces pendules ne s'accordent-elles pas? 10. Parce que l'une avance et l'autre retarde. 11. N'avez-vous point cassé le grand ressort de votre montre? 12. Je l'ai cassé en la remontant. 13. Votre pendule est-elle juste? 14. Oui, Monsieur; elle est juste; je viens de la faire régler. 15. La sonnerie de cette pendule est-elle dérangée? 16. La sonnerie en est dérangée et le timbre en est fêlé. 17. La petite aiguille de ma montre plate est cassée. 18. Le balancier de votre pendule n'est pas droit. 19. De combien votre pendule avance-t-elle? 20. Elle avance de cinq minutes par jour. 21. La perfection d'une pendule n'est pas d'aller vite, mais d'être réglée (DELIÉE). 22. Votre montre s'arrête-t-elle souvent? 23. Elle s'arrête tous les matins. 24. Votre pendule s'est arrêtée.

EXERCISE 180.

1. Does your watch gain or lose? 2. It does not lose; it goes very well. 3. It loses twenty-five minutes a day. 4. Does your clock gain much? 5. It gains one hour a week. 6. How much does your son's gold watch lose? 7. It loses much; it

loses one hour in (en) twenty-four (heures). 8. I have put it forward one hour. 9. I will put it back half an hour. 10. Does not your clock strike the half-hour? 11. No, Sir; it only strikes the hour. 12. Have you forgotten to wind up your repeater? 13. I have forgotten to wind it up, and it has stopped. 14. Is your silver watch out of order? 15. It is out of order, and it will be necessary to have it cleaned. 16. What o'clock is it by your watch? 17. It is three o'clock by my watch; but it gains. 18. How much does it gain a week? 19. It gains more than five minutes a day. 20. Is your watch right? 21. No, Sir; it is not right; it is out of order. 22. Does your clock strike right? 23. It does not strike right; the striking part is out of order. 24. Have you broken the hands of your clock? 25. I have broken the hour hand and the dial. 26. Has the clock struck three? 27. It has struck twice. 28. It has stopped. 29. Does it stop every morning? 30. It does not stop every morning; it stops every evening. 31. Your watch does not agree with mine? 32. Have you not broken the main-spring of your brother's watch? 33. He has broken it in winding it up. 34. My brother's watch is right; he has had it cleaned and regulated. 35. My sister's watch is not right; it requires cleaning.

KEY TO EXERCISES IN LESSONS IN FRENCH.

EXERCISE 77 (Vol. I., page 314).

1. Who has told you that? 2. The barrister has told it to me. 3. Have you spoken to him of this affair? 4. I have not yet spoken to him about it. 5. Have you seen him lately? 6. I saw him a few days ago. 7. Did you not write yesterday? 8. I saw him and wrote the whole day. 9. Have you not taken off your gloves and shoes? 10. I have not taken off my gloves, but I have taken off my hat. 11. Has not the tailor put on his hat? 12. Yes, Sir, he has put on his hat. 13. What have you done to that little boy? 14. I have done nothing to him. 15. Have you not told him that I am here? 16. I have not yet told him of it. 17. What have you studied this morning? 18. We have studied our lessons, and we have read our books. 19. Has the minister's gardener planted the pear-tree? 20. He planted it more than eight days ago. 21. Have you bought a black cloth coat? 22. I have bought one. 23. Have you worn it to-day? 24. I have not worn it yet. 25. We have put on our shoes and stockings this morning.

EXERCISE 78 (Vol. I., page 314).

1. Avez-vous étudié aujourd'hui? 2. Nous n'avons pas le temps d'étudier; nous avons lu une page. 3. N'avez-vous pas écrit à mon frère? 4. Je ne lui ai pas encore écrit. 5. L'Allemand n'a-t-il pas écrit à ma mère? 6. Il ne lui a pas encore écrit. 7. Avez-vous dit à ma mère que j'ai pris ce livre? 8. Je n'ai pas encore vu votre mère. 9. Qu'avez-vous fait ce matin? 10. Nous n'avons rien fait. 11. Avez-vous été votre habit? 12. Je n'ai pas été mon habit, il fait trop froid. 13. Le libraire a-t-il écrit à votre frère? 14. Il lui a écrit il y a longtemps. 15. Lui a-t-il écrit il y a un mois? 16. Il lui a écrit il y a plus d'un an. 17. Avez-vous planté un poirier? 18. Nous en avons planté plusieurs. 19. Faut-il trop froid pour planter des arbres? 20. Il fait trop chaud. 21. Qu'est-ce que le jardinier a fait à votre petit garçon? 22. Il ne lui a rien fait. 23. Quelqu'un lui a-t-il fait quelque chose? (Lui a-t-on fait quelque chose?) 24. On ne lui a rien fait. 25. A-t-il quelque chose? 26. Il n'a rien. 27. M. votre père a-t-il mis son chapeau noir? 28. Non, Monsieur, il n'a pas mis son chapeau noir. 29. Qu'a dit M. votre frère? (or Qu'est-ce que M. votre frère a dit?) 30. Il n'a rien dit. 31. Mlle votre sœur vous a-t-elle dit cela? 32. Elle me l'a dit. 33. N'avez-vous pas travaillé hier? 34. Nous n'avons pas travaillé hier, nous n'avons rien à faire. 35. Votre petit garçon n'a rien fait aujourd'hui.

EXERCISE 79 (Vol. I., page 315).

1. Have you brought us our clothes? 2. We have not yet brought them. 3. Have you forgotten them? 4. We have not forgotten them, but we have not had time to bring them. 5. Why have you not called the merchants? 6. I have called them, but they have not heard me. 7. Have you heard that music? 8. I have heard it. 9. Have you not seen the pretty flowers which I have brought? 10. I have seen them; to whom have you given them? 11. I have not given them to anybody, I have kept them for you. 12. Have you examined those engravings well? 13. I have examined them well. 14. Have you bought them? 15. I have not bought them. 16. Have you not received your income? 17. I have not yet received it. 18. Has the servant broken these cups? 19. She has broken them. 20. Has she broken cups on purpose? 21. She has broken none on purpose. 22. Have you bought bound or sewed (unbound, stitched) books? 23. I have bought bound books. 24. Have you said those words to us? 25. We have said them to you, but you have forgotten them. 26. I have not forgotten your errand.

EXERCISE 80 (Vol. I., page 315).

1. Avez-vous vu mes casses? 2. Je ne les ai pas encore vues. 3. M'avez-vous apporté mes livres? 4. Je ne les ai pas oubliés; je les ai laissés chez mon frère. 5. Votre mère a-t-elle appelé vos sœurs? 6. Elle ne les a pas encore appelées. 7. La domestique vous a-t-elle dit cette nouvelle? 8. Elle m'a dit cette nouvelle. 9. Elle me l'a dite. 10. Avez-vous oublié ma commission? 11. Nous ne l'avons pas oubliée; nous avons oublié votre argent. 12. Où avez-vous laissé votre bourse? 13. Nous l'avons laissée chez le marchand. 14. Avez-vous acheté les belles gravures que j'ai vues chez votre libraire? 15. Je ne les ai pas vues. 16. Votre mère les a-t-elle achetées? 17. Elle a acheté des livres, mais elle n'a pas acheté de gravures. 18. Cette petite fille a-t-elle cassé mes tasses? 19. Elle les a cassées exprès. 20. Cette dame reçoit-elle ses revenus tous les mois? 21. Elle les reçoit tous les six mois. 22. La maison que vous avez achetée est-elle grande? 23. Je n'ai pas acheté de maison. 24. Avez-vous reçu une lettre de M. votre père hier? 25. J'ai reçu une lettre de lui, il y a quatre jours. 26. Avez-vous parlé à ces dames? 27. Je leur ai parlé. 28. Leur avez-vous donné des fleurs? 29. Je leur en ai donné. 30. Les livres que vous avez achetés, sont-ils reliés? 31. Non, Monsieur, ils sont brochés. 32. Avez-vous examiné cette maison? 33. Je ne l'ai pas examinée. 34. Votre frère en a examinée plusieurs.

EXERCISE 81 (Vol. I., page 316).

1. At what hour did your sister come? 2. She came at a quarter to eight. 3. Were those young ladies born in Rouen or in Caen? 4. They were born neither in Rouen nor in Caen, they were born in Strasbourg. 5. Is the watchmaker at home? 6. No, Sir, he is gone to his warehouse. 7. Has he been in Paris this year? 8. Yes, Madam, he has been there. 9. Has he bought goods there? 10. He has bought jewellery there. 11. Did you go to my father? 12. I went to him. 13. Has your hatter gone out to-day? 14. He has not been out, he is sick. 15. Is the mason at home? 16. No, Madam, he is gone out. 17. When did he go out? 18. He went out an hour ago. 19. Did your hatter arrive to-day or yesterday? 20. He arrived yesterday, at four o'clock in the morning. 21. Has our tailor been to see his father to-day? 22. He has left for Lyons. 23. Has not my cousin's goldsmith left for Spain? 24. No, Sir, he has returned to Germany. 25. My sister has been at church this morning, and she went (is gone) to school half an hour ago.

EXERCISE 82 (Vol. I., page 316).

1. Le médecin est-il à la maison? 2. Non, Monsieur, il n'est pas à la maison, il est sorti. 3. Avez-vous sorti ce matin? 4. Non, Monsieur, je n'ai pas sorti, je suis malade. 5. La petite fille de votre sœur est-elle sortie? 6. Oui, Monsieur, elle est sortie, elle est chez mon frère. 7. A quelle heure le chapelier est-il arrivé? 8. Il est arrivé hier au soir à neuf heures. 9. Le bijoutier a-t-il été à Paris ou à Lyon cette année? 10. Il a été à Paris il y a six mois, mais il est de retour. 11. Avez-vous été trouver mon frère ou ma sœur? 12. Je n'ai pas eu le temps d'aller les trouver. 13. Où ce monsieur est-il né? 14. Il est né en Angleterre, à Exeter ou à Portsmouth. 15. Votre sœur n'est-elle pas née à Paris? 16. Non, Monsieur, elle est née à Madrid, en Espagne. 17. M'avez-vous dit que M. votre frère avait acheté une bonne maison? 18. Il a acheté une très bonne maison à Londres. 19. Savez-vous à quelle heure l'horloger est arrivé? 20. Il est arrivé ce matin à cinq heures moins un quart. 21. A-t-il apporté beaucoup de bijouterie? 22. Il n'a pas apporté beaucoup de bijouterie, mais il a apporté beaucoup de montres. 23. A-t-il été en France ou en Allemagne? 24. Il a été en France, en Allemagne et en Suisse. 25. Mlle votre sœur est-elle à la maison, Monsieur? 26. Non, Monsieur, elle est sortie, elle est allée à l'église. 27. A-t-elle été à l'école, hier? 28. Elle a été à l'école et à l'église. 29. Y est-elle à présent? 30. Non, Monsieur, elle en est revenue. 31. Le chapelier est-il arrivé? 32. Oui, Monsieur, il est arrivé. 33. Quand est-il arrivé? 34. Il est arrivé hier, à neuf heures du matin.

LESSONS IN CHEMISTRY.—XIV.

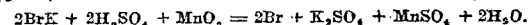
BROMINE.

SYMBOL, Br. — ATOMIC WEIGHT, 80 DENSITY, 3.12.

IN many of its properties this element resembles chlorine, but its affinities are not so strong, since it can be displaced from its combinations by that gas. It owes its name to the severe manner in which it affects the respiratory organs. Βρῶμος is the Greek for "stench." It never occurs free in nature, but is found combined with magnesium in sea-water, especially in that of the Dead Sea. The peculiar smell of sea-weed is due to its presence. Berthier discovered it in a silver ore from Mexico, but it is invariably obtained from the "mother liquor" of the sea. When a solution is evaporated until a film appears on its surface, it is called the "mother liquor," because as soon as it cools it will give birth to crystals of the salts in solution.

Preparation.—A quantity of sea-water is reduced by evaporation; the crystallisable salts, sodium chloride, etc., "crystallise

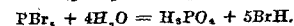
out," into the "bittern" which thus remains a stream of chlorine is passed. The chlorine seizes the magnesium, and sets free the bromine, which gives a reddish-yellow colour to the liquid. The bittern is now shaken with ether, which dissolves the bromine and floats on the surface; it is decanted into a glass vessel; a little caustic potash being added, potassium bromide is made. This process is frequently repeated, the same ether being used. The potassium bromide thus prepared is mixed with black oxide of manganese and sulphuric acid in a retort; heat being applied, bromine distils over. The reaction is thus expressed:—



It will be noticed that this process is identical with that of liberating chlorine from common salt.

Properties.—Bromine is a liquid of a deep red colour, having a density of 2.966. It boils at 47° Cent., and evaporates at all temperatures. Its vapour is a dense red. If swallowed, it operates as a powerful irritating poison. It bleaches more feebly than chlorine, but will not support the combustion of a taper. It combines with many metals forming "bromides."

Hydrobromic Acid (symbol, HBr; combining weight, 81; density, 4.05).—This compound cannot be made like hydrochloric acid from the combination of hydrogen and bromine in the sun-light, but the elements will combine if passed through a red-hot porcelain tube. It may also be obtained by decomposing the bromide of phosphorus by water. Thus—

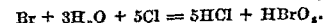


The experiment is performed by a tube bent as in Fig. 44. In the bend r pieces of phosphorus are placed, separated from each other by fragments of moistened glass. In the bend b is placed a little bromine, and the tube closed by a cork. On applying a gentle heat at r, the bromine vapours pass into r, where the bromide of phosphorus is formed and is decomposed by the water on the glass. The hydrobromic acid thus produced passes out from r. It is a colourless gas, and can be liquefied under strong pressure. Its action on metallic oxides is analogous to that of hydrochloric acid, forming a bromide of the metal and water.

COMPOUNDS OF BROMINE WITH OXYGEN.

Hypobromous Acid (Symbol, HBrO).—An aqueous solution of this acid can be obtained by agitating bromine water with the oxide of mercury. In distilling the solution, care must be taken not to raise the temperature above 30° Cent., lest the hypobromous acid should be decomposed into bromic acid and free bromine. The aqueous solution of the acid is light yellow, has a sweetish taste, and is a powerful bleaching agent.

Bromic Acid (symbol, HBrO₃) is formed when chlorine is passed into bromine water. Thus—



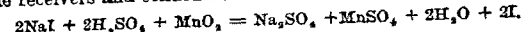
With bases this acid forms "bromates," which salts are decomposed by heat in the same way as chlorates.

Bromine forms with hydrogen an oily detonating liquid, which resembles the chloride of nitrogen.

IODINE.

SYMBOL, I.—COMBINING WEIGHT, 127—DENSITY, 4.93.

Iodine is found in the sea in really less quantities than bromine, but it is obtained with more ease, for the sea-weeds store it in their tissues. When these are burnt, the ash, which is called kelp, is broken into small fragments, digested with boiling water, and the solution thus formed is evaporated down until a film forms on its surface, when it is set aside to crystallise. Sodium sulphates and carbonates and potassium chloride separate. The mother liquor is treated with one-eighth of its bulk of sulphuric acid, and after it has stood to allow the precipitates to fall, and some of the sulphates to crystallise out, the clear liquid is mixed with manganese dioxide, and introduced into a leaden retort. Upon the application of heat, iodine passes into the receivers and condenses. The reaction is—

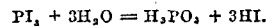


Properties.—Iodine is a solid, which crystallises in plates, having a brilliant metallic lustre; when a little is heated at the bottom of a test-tube, beautiful violet vapours are given off, which condense in the upper part of the tube into the solid iodine. This colour gives the element its name, ἰώδης being the Greek for violet.

Iodine gives off vapour at all temperatures, and must therefore be kept in a bottle with a glass stopper, as the vapours attack cork. The skin and organic bodies are stained by it yellow. This stain, however, passes away so soon as the iodine evaporates. It is slightly soluble in water, this liquid being capable of holding $\frac{1}{1000}$ of its weight in solution. It is freely dissolved in alcohol and ether, and a minute piece of iodine imparts a rich colour to bisulphide of carbon; but the chief liquid employed for its solution is the solution of a soluble iodide, such as potassium iodide.

The most delicate test for iodine is the intense blue colour it imparts to starch. However, to effect this, the iodine must be in an uncombined state. Chlorine water or nitric acid will always liberate iodine from its combinations, and therefore, if the presence of an iodide be suspected, add one or other of these agents to the solution, and then the starch paste. One part of iodine, dissolved in a million parts of water, will be made apparent by this test.

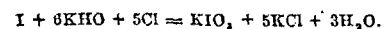
Hydriodic Acid (symbol, HI; combining weight, 128; density, 61).—This acid is best prepared in a manner similar to that by which hydrobromic acid was procured—namely, by acting on phosphoric iodide with water, thus—



However, it may be made directly by heating iodine in an atmosphere of hydrogen; or a solution of this acid may be easily prepared by suspending iodine in water, and transmitting a current of sulphuretted hydrogen gas until the brown colour disappears. Sulphur is deposited, and hydriodic acid formed, which goes into solution in the water. If this solution be exposed to the air in sunlight, it gradually absorbs oxygen, the hydrogen of the acid forming with it water, and the liberated iodine renders the liquid brown. Iodides are formed by replacing the hydrogen of the above acid by the metal, according to its atomicity. When iodides are heated, the iodine goes off, and an oxide of the metal is formed. Of course, in the case of the noble metals (Au, Ag, Pt, and Hg), the metal remains. The elements, chlorine and bromine, when acting on iodides, have the power to remove the iodine, and insert themselves in its place.

Oxides of Iodine.—This element has a greater affinity for oxygen than either of the preceding halogens; but of its oxides, the only two which have been studied are *iodic acid* and *periodic acid*. *Iodic acid*, or *hydriodic acid* (symbol, HIO_3), corresponds closely to chloric acid. It is prepared by the action of strong nitric acid on iodine. When the iodine has nearly disappeared, the liquid upon cooling gives crystals of iodic acid.

When iodine is dissolved in caustic potash or soda, the result is a mixture of iodide and iodate of potassium or sodium. The iodate being much the most difficult to dissolve, may easily be separated from the iodide. Or if, in the course of the process, chlorine gas be passed, then no iodide is formed; thus—



When iodates are heated, they behave like chlorates, giving off oxygen.

Iodic acid is at once decomposed by sulphurous acid. This provides a test for the presence of sulphur in any combustion. Soak a piece of paper in a mixture of potassium iodate and starch-paste, then expose it to the fumes; if any sulphurous acid be present, the paper becomes blue. Morphia possesses a like power, and hence by this test the presence of this powerful poison may be detected.

Periodic Acid, or *Hydriodic-periodic acid* (HIO_4).—This acid can only be obtained in combination. Sodium per-iodate ($NaIO_4$) may be prepared by passing chlorine through a solution

of three atoms of caustic soda, and one atom of sodium iodate.

Nitric iodide, which is generally supposed to be the tri-iodide of nitrogen (NI_3), is an interesting compound, from the readiness with which it explodes. Place a little iodine in a capsule, and pour upon it sufficient ammonia to cover it well. Allow this to digest for half an hour; then pour off the supernatant liquid, and place the brown substance upon pieces of blotting paper—a little on each paper; leave them to dry, if by a fire, at some distance from it. When dry, a shake of the paper is sufficient to determine the decomposition with explosion.

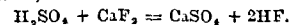
Iodine is noted in the medical world for its great powers of absorption. Glandular swellings may be removed by it which have resisted every other means. It is used for this purpose in a solution, which is made as above described. Its action is greatly accelerated if a few grains of potassium iodide be taken internally each day.

FLUORINE.

SYMBOL, F—ATOMIC WEIGHT, 19.

Hitherto no attempt to isolate this element has been successful. Its affinities are so powerful, and its action on the human frame so violent, that little is known of it. Its only compound which occurs in any abundance, is Derbyshire spar, calcium fluoride (CaF_2). Many minerals contain this salt in small quantities. It is detected in teeth, and even in the blood of animals. Fluorine is not known to combine with oxygen, nitrogen, sulphur, or the other halogens.

Hydrofluoric Acid (symbol, HF; combining weight, 20; density, 10).—To prepare this acid, Derbyshire or fluor spar is reduced to a powder, introduced into a leaden or platinum retort (Fig. 45), and then mixed with sulphuric acid. Upon the application of heat, this reaction ensues—



The bent part of the tube in Fig. 45 is immersed in a freezing mixture, and here the hydrofluoric acid condenses into a colourless liquid.

It is an energetic acid, and has the power of conveying metallic oxides into water and metallic fluorides. Of all chemical substances, its effect on the skin is the most painful. It will produce a sore which exhibits but small inclination to heal. Its most characteristic property is its power to etch on glass. It effects this because with silica—one of the constituents of glass—it forms a gaseous product (SiF_4), hydrofluosilicic acid: thus—



To exhibit its effects, a glass plate is covered with bees-wax upon which fluorine has no action and any design traced with a sharp point in the wax. This is exposed to the vapour of hydrofluoric acid and the parts of the glass exposed are etched; the glass is "frosted" by the vapour; but if the solution of the acid, which is sold in gutta-percha bottles, be poured on glass, the glass is eaten away. Any photographic artist will at once appreciate this fact to enable him to remove the frost from the back of the glass stereoscopic slides, and thus it will be possible to take "prints" from them.

The halogens form the best defined of natural groups of elements. Their atomic weights are almost in arithmetical progression.

F	=	19.
Cl	=	35.5.
Br	=	80.
I	=	127.

Chlorine is a gas, bromine a liquid, and iodine a solid. Moreover, bromine, in its affinities, is a mean between chlorine and iodine, and all form directly, with the metals, salts.

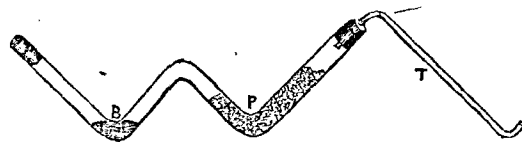


Fig. 44.

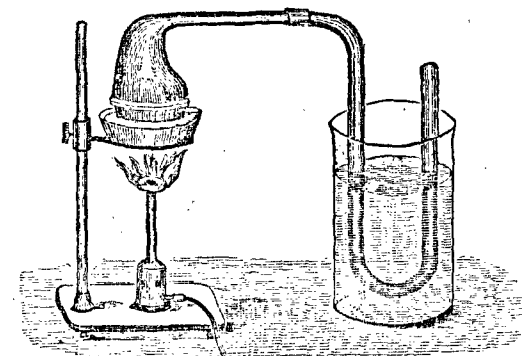


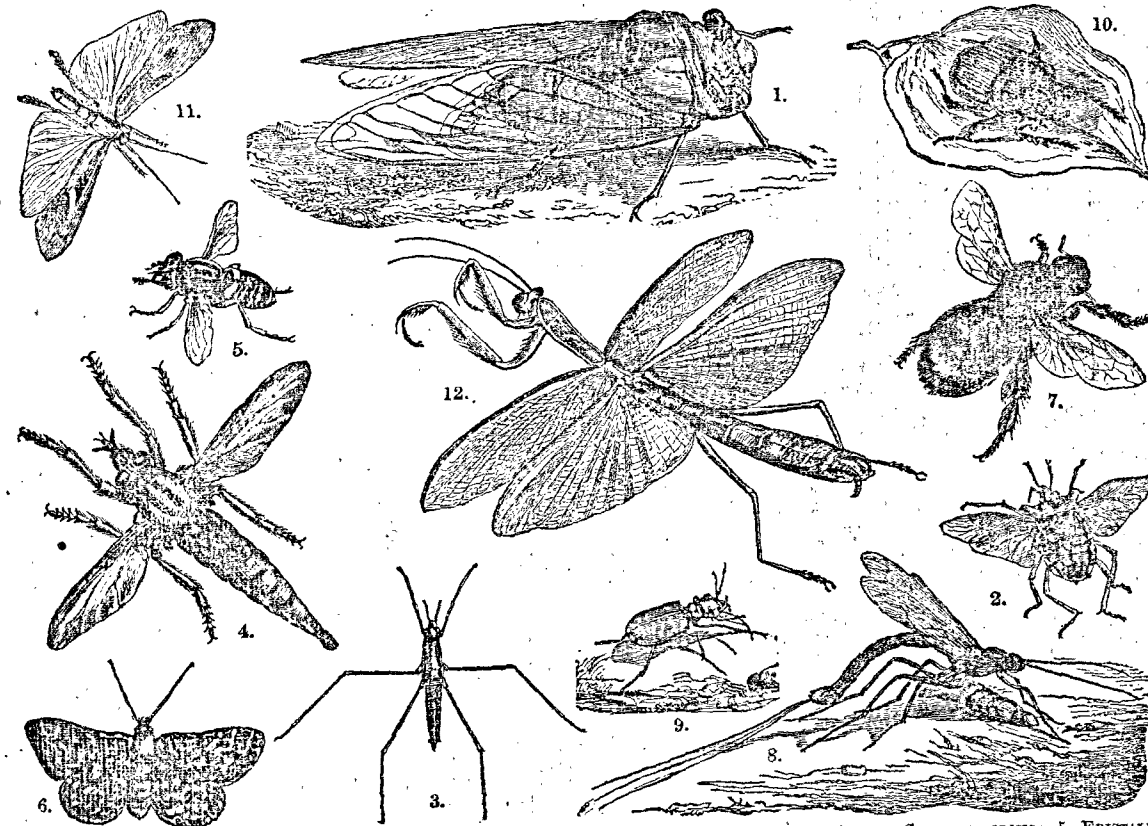
Fig. 45.

COMPARATIVE ANATOMY.—XI.

INSECTA—CLASSIFICATION.

ENTOMOLOGY, or the study of insects, has always been a favourite branch of natural history. The great beauty, both of form and colouring, to be found in many of the species of this class has always commended it to the attention of all who have any bent towards such studies. Probably the hues of the gorgeously-tinted butterfly, or the elegance and graceful activity of the dragon-fly, have been the first incitement to many a youth to the study of living creatures. Besides these, many thousands who have no claim to be called naturalists have found great pleasure in collecting and preserving insects. "A thing of beauty is a joy for ever," and whether the external

of insects, to have expended her most exquisite workmanship in the architecture of their superficies, or the boundary between themselves and the outer world. The character, the capabilities, and the efficiency of insects depend mainly on the framework of their external casing. This external casing is the resisting and supporting structure upon which all the soft parts are built. From this peculiarity of structure it follows that when an insect is dried—when the muscles have withered and its nervous, nutritive, and reproductive organs have shrivelled or decayed—since they are all internal, not only is its beauty left intact, but all the essential features by which its habits and relationships may be determined are undestroyed. Moreover, it is found that when any class has any great peculiarity, any part specially well developed, the modifications of



HEMiptera:—1, CICADA (AN HOMOPTEROUS INSECT); 2, HALYS; 3, HYDROMETRA. DIPTERA:—4, ASILUS CRABRONIFORMIS; 5, Eristalis. LEPIDOPTERA:—6, EUCLIDIA MI. HYMENOPTERA:—7, APATHUS; 8, AN ICHNEUMON FLY. COLEOPTERA:—9, CIGINDELA; 10, GEOTRUPES. NEUROPTERA:—11, PHRYGANEA. ORTHOPTERA:—12, MANTIS RELIGIOSA.

stamp of excellence called beauty induces men to examine and appreciate the other excellences of Nature or not, it is good that the great God should receive the praise of a thousand joyous hearts for this alope. The collection and study of insects is pursued with greater ease than that of any other class. Found everywhere in almost infinite variety, they offer an unlimited field in which every lover of Nature can occupy himself. Their size, ranging as it does between a very few inches in length down to an almost limitless minuteness, enables them to be stored, notwithstanding their great multitude, in a space which is at the command of every one. All these facilities for the collection and study of insects would, however, be nugatory if it were not for the peculiarities of their structure. As we have seen in our last lesson, the great peculiarity and excellence of insects is the perfection of the organs of relation, as they are called. By organs of relation is meant the organs through which the animal acts upon, or is brought into contact with, the outer world, such as organs of sense, locomotion, and prehension; of attack and defence. Hence Nature seems, in the case

that part furnish the best means of classifying the members of that class into minor divisions. Thus, the gills of fish, the breast-bone of birds, and the intra-uterine connection of mother and offspring in brutes, all of which are peculiar or peculiarly developed structures, are made use of severally to divide fish, birds, and brutes into minor sub-divisions. Hence it follows that though in our insect cabinets we have only the dry and lifeless husks of insects, yet we have in them a means of comparing and classifying insects which probably would not be much increased if the whole of the organs were preserved. These advantages have no doubt largely tended to make the study of entomology popular. A class which can be studied with any degree of completeness without recourse to the difficult process of dissection, is sure to receive attention. A simple cult process of dissection, of low power, directed upon the exterior of a set specimen, is quite sufficient to determine not only its place in all existing classifications, but even to furnish all the information on which the reasons for the adoption of the several systems of classification are based. Nevertheless,

though all that has been stated is true, though the museums of Europe contain vast collections gathered from all parts of the earth, though the class itself is so rich in species that in it, if anywhere, we might hope to find a complete series which could throw light on the general principles of classification—the arrangement of insects into minor groups is by no means placed on a satisfactory footing. The external parts of insects have been examined with a minuteness and described with a care which strikes the uninitiated with wonder. Not only the shape of all the plates composing the rings of the body, and the number and form of the joints of the legs and antennae, have been made to yield characters for classification, but even the number and shape of the joints of the appendages of the mouth-organs, and the direction and number of the nervures of the wings, together with the shape of the cells which they circumscribe, have been impressed into the service of taxonomy. Yet naturalists are far from agreeing in the arrangement of insects into their larger groups. Some classifiers place all insects under seven groups or orders, and some are not contented with less than double that number. Concerning the more conspicuous and independent insects there seems to be a considerable agreement as to classification, and these are comprised under seven orders. The additional orders of those who make more orders than seven are made of minute and generally parasitic insects. These, owing to the peculiarity of their method of life, constitute what may be called *aberrant* groups—that is, groups which depart considerably from the ordinary typical forms of insects. This idea of aberrant forms will become clearer when we come to describe the several orders. These aberrant groups of insects have been constituted into new orders, or included under the older and better established orders of the more conspicuous insects, according as each classifier is more prone to dwell on the differences or the resemblances of animal forms.

Without going into the merits of the several systems, we shall adhere to that classification by which all insects are arranged into seven orders, because this system will probably give to the reader a clearer idea of the different groups of insects than the ampler system. We have therefore to distribute the aberrant groups among these seven orders, but in so doing we shall call attention to them, so that the reader may not be perplexed when he refers to other systems of classification.

The class *Insecta* is well defined by the following characters. They are animals with well-developed jointed limbs, one pair of antennae or head-feelers, compound eyes, feelerless upper jaws (mandibles), a distinct head, a trisegmented thorax, to which is attached three pairs of legs, and (normally) two pairs of wings, limbless abdomen, and respiration by tracheae.

The terms used in this classification will be understood by those who have read the last lesson. The whole definition is necessary, in order to cut off the insects from all the neighbouring classes. Thus they possess jointed limbs in common with centipedes, spiders, and crustaceans, but they are by their character cut off from the worms. Centipedes (*Myriopoda*) have one pair of antennae, as insects have, but this peculiarity severs these classes from the spiders, which have no antennae, and also from the crustaceans, which have two pairs. On the other hand, the absence of limbs on the last division of the body, while it is likewise characteristic of the spiders, completely separates them from the myriapods and crustaceans. The possession of two pairs of wings is peculiar to insects, but still this is not a good distinctive character, because wings are not found in all insects.

Insects as thus defined may be divided into the following orders, to each of which we affix the ordinal definition:—

1. *Hemiptera* (half-winged).—Insects with imperfect metamorphosis, free prothorax, and suctorial mouths.
2. *Diptera* (two-winged).—Insects with perfect metamorphosis, suctorial mouths, membranous naked fore-wings, and aborted hind-wings.
3. *Lepidoptera* (scale-winged).—Insects with perfect metamorphosis, suctorial mouthed organs, and membranous fore and hind wings, covered with close-set coloured scales.
4. *Hymenoptera* (membrane-winged).—Insects with perfect metamorphosis, biting jaws, small ring-shaped prothorax, firmly fastened by its upper part to the succeeding segment, and membranous fore and hind wings, of which the latter are the smaller.

5. *Coleoptera* (sheath-winged).—Insects with perfect metamorphosis, biting jaws, free, strongly-developed prothorax, and hard, horny fore-wings (Elytra).

6. *Neuroptera* (net-winged).—Insects with perfect metamorphosis, biting jaws, free prothorax, and membranous fore and hind wings.

7. *Orthoptera* (straight-winged).—Insects without or with imperfect metamorphosis, biting jaws, and the first segment of the thorax united to the second segment.

One thing should be noted in this ordinal arrangement which otherwise might perplex the student. The Dragon-fly family, with its nearly allied families of the Epheméridæ (May-flies) and the Perlidæ, are transferred from the Neuroptera to the Orthoptera on account of their having a free prothorax. Now the dragon-fly was once considered to be the very type of a neuropterous insect, and it seems probable that Linnæus intended that it should be the type of the order he constituted; nevertheless, it is certain that the dragon-flies and the may-flies show a nearer relationship to the Orthoptera than the rest of the so-called Neuroptera.

The Hemiptera are so named from the fact that many of them have their fore-wings distinctly divided into two parts; the anterior and outer half being horny, like the wing-cases of a beetle, while the inner and hind half is membranous, like the wing of a bee.

As this peculiarity only belongs to one large division of the order, some naturalists have given to it the name *Rhynchota*, or beaked insects, on account of the long rostrum or sucking snout which is found in every member of the order.

The order is divided into two tribes, the *Homoptera* and the *Heteroptera*. In the Homoptera (like-winged) the wings are of the same consistency throughout. One of the largest and most celebrated of these insects is shown in the illustration. The insect represented is the female. The male is larger, and is furnished underneath with two large plates covering in a muscular apparatus, which it plics most vigorously both during the day and night. The writer took this insect in Italy, where it abounds, and has been known since classical times. The ancients called the cicada happy, because it had a dumb wife. The cochineal insect, the aphides—whose periodical presence in vast multitudes on plants is commonly called a blight—the Chinese lantern-fly, and the frog-hopper, all belong to this sub-order. Lice and bird-lice (*Pediculina* and *Mallophaga*) may also be considered to be aberrant families of this sub-order, though some have made separate orders for each of them.

The Heteroptera (unlike-winged) have wings such as have been described as giving their name to the Hemiptera. The insect marked 2 in the illustration may be taken as a type of this sub-order. The water-scorpion, the water-boatman, and the hydrometra each represent families of this sub-order. The last-named is represented in the engraving. It may be seen skating over the surface of every piece of water in summer and autumn.

The Diptera may be divided into the flies proper and two aberrant families. The lowest of these families is well known to us, being represented by the almost ubiquitous flea. The mouth-organs of this insect are very different from the genuine flies, and in the place of wings they have only four scales, which appear to be quite useless. Nevertheless, they appear from their metamorphosis, and for other reasons, to be more nearly allied to the Diptera than to any other order. The Pupipara is the name given to other insects which are also parasitic and wingless. These pass the whole of their larva state in the body of the mother.

The genuine flies may be divided into two great divisions, one of which, the *Brachycera* (short-horned), have short antennae composed of three joints, while the palpi are of one or two joints; the other sub-order, named *Nemocera* (thread-horned), have their whip-like antennae (sometimes beaded) in many joints, while the maxillary feelers are four or five-jointed. The antennae also often have fine secondary hairs springing from each joint, which gives them the appearance of a plume. This, in the common gnat, is a very pretty object. The common daddy-long-legs (*Tipula*) is a good example of this order. Both of the flies in the illustration belong to the *Brachycera*. The hornet-fly is one of the largest of our British Diptera, and while in flight is very like the insect from which it derives its specific name. The Lepidoptera have been variously divided into great

The sub-order, *Macrolepidoptera*, includes the day-flying butterflies, with knobbed antennae, the hawk-moths (*Sphingidæ*), the thick-bodied moths (*Bombycidæ*), the nocturna, and the loopers (*Geometridæ*); while the other sub-order, *Microlepidoptera*, comprises the pearl-moths (*Pyrallidæ*), the bell-moths (*Tortricidæ*), the cloth-moths (*Tineina*), and the plume-moths (*Pterophoridae*). The moth in the engraving belongs to the *Nocturna*, and is called *Euclidia* on account of the pattern of geometrical figures formed by the coloured scales of the wings.

The *Hymenoptera* are divided into the *Aculeata*, or stinging; the *Entomophagous*, or insect-eating; and the *Phytophagous*, or plant-eating, sub-orders. Some species of the latter sub-orders can prick, but the *Aculeata* are those which have a perforated sting leading from a poison-bag. The males of these have thirteen joints, and the females twelve joints, to their antennae. The abdomen is connected with the thorax by a very thin stalk. The females, or workers, usually feed the larvae or grubs, which are walled up in cells. The bee, the wasp, and the ant each represent different families of this order.

In the entomophagous *Hymenoptera*, the females are furnished with an ovipositor, placed between two side-plates, which are usually stretched freely out from the end of the abdomen, and are often of great length. This complex instrument is made use of to insert the eggs deep into the bodies of the larvae of other insects, in the abdominal cavity of which the footless larvae live parasitically, and there change into pupae. Hence the enthusiastic lepidopterist who breeds his moths from caterpillars is often woefully disappointed by having a brood of ichneumon-flies emerge from the chrysalis, whose once living tenant they have entirely consumed. No. 8 in the illustration represents an entomophagous insect. In the phytophagous *Hymenoptera*, the abdomen is joined to the thorax by its whole width, and not by a stalk. These insects are called saw-flies, because they are furnished with a double saw at the end of the body, with which they saw into wood, and there deposit their young, which, when hatched, are herbivorous.

The beetles (*Coleoptera*) form a well-defined order, with scarcely any other approach to other orders among any of their numerous families; and none of these families can be called aberrant—that is, they cannot be said to stray far away from the true beetle type. By some, the *Brachelytra*—which have short wing-cases (as their name implies), under which their flexible wings are closely doubled up, thus leaving the rings of the hind part of the body exposed to view—are related to the *Forficulidæ*, an orthopterous order. Certainly there is much external likeness between the devil's coach-horse and an earwig, which two insects represent the two families named, but this is rather a spurious resemblance than a true affinity. The main divisions of the beetles have been founded on the number of the joints of the foot below the tibia. Thus the *Pentamera* have five joints to all their feet; the *Heteromera* have four joints to the feet of the third pair of legs, and five to the others. The *Cryptopentamera* have apparently four joints to all their feet. This appearance is occasioned by the great reduction in size, or, as it might be called, the abortion of one of the joints of each foot. The *Trimera*, similarly, have apparently three-jointed feet. Both the bees in the engraving belong to the *Pentamerous* division. The *Cicindela* is a carnivorous beetle, and the *Geotrupes* is an herbivorous lamellicorn. The last joints of the antennae are produced into flat, appressed plates.

The *Neuroptera*, narrowed by the transference of the dragon-flies and the may-flies to the Orthoptera, are divided into the *Pemipentera*—in which the hind-wings are like the fore ones, and not folded—and the *Tricheptera*, in which the wings are hairy or scaly, and the hind pairs folded. To these divisions, also, must be added the aberrant sub-order, called *Strepsiptera* (screw-winged). The males of these have curious twisted and aborted organs to represent the fore-wings and widely expanded hind-wings; while the females are wingless, and inhabit the bodies of bees, between the segments of whose abdominal rings they thrust forth their heads.

The Orthoptera, as defined above, comprise not only the genuine Orthoptera represented by the cockroaches, walking-leaves, grasshoppers, and crickets—whose main characteristic is the folding of their broad hind-wings longitudinally, after the manner of a lady's fan—but also the white ants, the earwigs, and dragon-flies, etc., and also two aberrant groups, called

Physopoda and *Thysanura*. The earwigs (*Dermaptera*) are distinguished by their short, leathery, unveined elytra or fore-wings, which cover the membranous hind-wings. These latter are folded when at rest, first in a longitudinal direction, and then doubled up transversely, so as to occupy but little space. When extended, these membranous wings are in shape like the human ear, hence the name ear-wing, and its corruption earwig. The pincers at the end of the body, the uses of which are so little known, furnish another character which is conspicuous to all. Two more aberrant sub-orders, the *Corrodentia* and *Physopoda* (bladder-footed), are of little importance. Another, called the *Thysanura*, is remarkable for having long bristles at the end of the body, which in the *Podura* are bent under the body, and serve as springs to jerk the insect into the air when it wishes to leap, much after the manner of the toy leaping-frog. These creatures have their bodies covered with scales, which are so small yet so beautifully symmetrical in their markings as to make excellent test objects for the high powers of a microscope.

The tribe to which the white ants belong is called *Orthoptera socialia*, because they live in communities. Although they belong to quite a different order from the true ants, yet the popular name is justified by the fact that their habits are closely similar to them. It is a singular coincidence that in both the cases of the true and the white ants there are not only males and females in the community, but also neutral wingless forms, which, though themselves sterile, are highly instrumental in presiding over the reproduction and rearing of the young from the other fertile forms, and also in the defence of the nest and community. In the case of the Termites, the neuters are called soldiers, because of their immense jaws, wherewith they attack all intruders. The larva and pupae are active, and do the work of the community. The female has wings which have only a temporary use. When pregnant, she is placed in a royal apartment, and fed while she increases to an enormous size, preparatory to the production of some 80,000 eggs.

The Praying Mantis is a good example of another family. The cognomen is applied on account of the bent fore-legs of the animal, which are supposed to represent the attitude of prayer. The mantis, however, uses them to inflict painful wounds by the aid of the sharp-pointed tibia. This insect is an excellent example of the *Gressorial Orthoptera*. The saltatorial Orthoptera are well known as grasshoppers and crickets.

LESSONS IN ENGLISH.—XXVII.

THE LATIN ELEMENT.

In our last lesson (Vol. II., page 374) we finished our inquiry into the influence that the ancient language of the Greeks has exerted on our tongue, and we now pass on to the Latin element in the English language.

That element can by the ordinary student be appreciated and acquired but imperfectly. I will, however, do what I can to aid him. Had I had the direction of his studies from the first, I would have done my best to make him at the beginning master of the Latin language. As it is, I must content myself with offering to his diligent attention the chief Latin roots which enter into the body of our tongue. Possessed of these, together with their signification, he will in general be at no loss, even without the aid of a dictionary, for the meaning of a word of Latin parentage. Seldom, however, do the words in English which may be traced back to the Latin, come into our tongue directly from the Roman soil. They have generally passed through intermediate countries.

From the Latin are formed several modern languages, namely, the French, the Italian, the Portuguese, and the Spanish. These are called the Romance languages, because they are essentially Roman in their origin. Some say they received the name because in them the first romances were written; more probably is it that the fictions so called were denominated from the languages in which they appeared.

It is not immediately from the pure Latin of the Latin classics, such as Livy, Cicero, Virgil, Horace, and Tacitus, that the Romance languages are derived, but rather from these so far as they were found in the vernacular tongue, the spoken language of the population in the great centres of intercourse

and in rural districts. This vernacular tongue would be regarded by the Roman purists as a corrupted form of the Latin. Corrupt, doubtless, it was, for it contained many words of merely local prevalence, of low origin, and of no authority. Nevertheless, in it were preserved both terms and forms which, being of a very early origin, like our English dialects, belonged to the very substance of the language.

Already in the bloom of the Roman power, the Latin language had received a very large infusion of foreign elements from the several nations which lay around it as a centre, and over which it had established its sway—the countries which we now term France, Italy, Spain, and Portugal. Though the original population of these wide districts had, in common with the Romans, a Celtic basis for their language, yet, from locality and diverse culture, they had each for themselves formed a different tongue; and these diversities, when the Roman authority became supreme, and the Roman language was introduced under the wing of that authority, readily blended themselves with the more refined diction of the metropolis and of the great Roman writers. Causes of diversity did not fail to appear on the establishment, in a land, of the Roman despotism. These causes vied in their operation. At last a new cause, a cause of tremendous power, came into play—the invasion of the northern Barbarians. The blow broke the Roman empire in pieces. Out of the consequent ruins arose new forms of government—the forms of our present European kingdoms. With the formation of new centres of political power and social influences, new languages were formed—the French, the Italian, the Spanish, the Portuguese; at least, these are the main branches that shot forth from the old trunk and grew, until in separate literatures they each produced fruit. Our English was not without an influence from the general shock; but chiefly from the Romance languages, when they had received each its individual form and character, did the Saxon basis of the English tongue receive additions and incorporate elements. Latin came to us in the conquering train of William of Normandy. His Norman-French, a Romance tongue, like his bold barons, and generally his superior culture, made war on the old Saxon element of our land, defeated it, took it prisoner, and went far to make it do its own bidding. So overpowering was the influence of the court, and so imperious was the sway of fashion, that the first accents of our English literature were compelled to take a Gallic shape and tone, retaining their mother Saxon as best they might, and uttering the native sounds “with bated breath.”

The Italian branch of the Romance language introduced our English through the medium of the Roman Catholic Church, whose Latin, of universal prevalence, was a sort of medium, and as a medium, so a stepping-stone, between the classic purity of the old Latin language and the new languages of mediæval Europe; and whose forms, ceremonies, officers, laws, and courts combined to infuse into English a copious and pervading Latin element.

As the Spaniards and Portuguese made their conquests in foreign climes, and becoming masters of the ocean, held commerce in their hands, so they, in conducting their maritime and commercial transactions, gave to all modern languages words belonging to their tongue, and the names by which, with more or less accuracy, they denominated the articles of foreign produce which formed the staple of their trade.

At later periods, too, the Romance languages have exerted an influence over the English, and left bequests which remained after the source of that influence had ceased to exist. I may instance the reign of the profligate Charles II., when, with a Portuguese princess for his queen, that monarch, dependent on French bounty, allowed French writers and French tailors to set the fashion in England, and the language of high life, and partly of books, became a mongrel of bad French and worse English.

Abbreviation is one of the forms through which languages pass in their natural development. By abbreviation has the Latin passed into the Romance languages. The abbreviation has not been in the structure of sentences; for in the structure of sentences expansion has taken place, and fulness ensued, so that it is difficult to render by the same number of words a passage from a Latin classic into a Romance tongue. The abbreviation has been in the forms of the words: the inflexions have been curtailed; case-endings and person-endings, even to some extent tense and mood-endings, have been diminished or done away. The words thus set free from bonds have followed

new impulses of development, and given birth to new modes of utterance conformably with the progress of our modern civilisation; and even produced new languages, any one of which would not suffer in comparison with classic Latin.

I have already intimated that the Saxon did not receive any very large inheritance immediately from the confused mass of words and tongues which ensued from the social collision of the North and the South. Yet do we owe to the Romance languages so much, that I am not at liberty to pass on until I have given some particulars, the rather that without the facts that ensued, a knowledge of the English lacks an important element.

Out of an original Latin term two or more English words were formed, either by some change in the body of the word, or some change in its termination. Of those newly-coined words, one will be found to bear a close resemblance to its original; another will have departed from it in form and in meaning to a greater or less extent: the former is the older, probably the more scholar-like; the latter is the more recent and the more popular. I subjoin a few instances, annexing contractions to show whence the terms have come to us, thus: *Fr.* shows that the word is derived directly from the French; *It.* from the Italian; and *Sp.* from the Spanish. When the English word seems to come to us immediately from the Latin the contraction *Lat.* is prefixed:—

Blasphemare, to revile,	<i>Fr.</i> to blaspheme, blame.
Calx, limestone,	<i>Fr.</i> to calcine, calcination.
Calculus, a pebble,	<i>Fr.</i> to calculate, calculus.
Campus, a plain,	<i>Fr.</i> camp, champagne.
Canalis, a pipe,	<i>Fr.</i> canal, channel, kennel.
Cantus, a song,	<i>Fr.</i> chant, enchant, canticle.
Caput, a head,	<i>Fr.</i> chap, chapter, cap, captain, capital, chief.
Causa, a cause,	<i>Fr.</i> cause, causation, accuse.
Charta, paper,	<i>Fr.</i> chart, charter.
Clamare, to shout,	<i>Fr.</i> claim, exclaim, reclaim.
Commendare, to entrust,	<i>Sp.</i> commend, recommend.
Comparare, to get together,	<i>Sp.</i> compare, prepare.
Consuetudo, custom,	<i>Fr.</i> costume, custom.
Divinus, divine,	<i>Fr.</i> divine, a divine, a diviner.
Dominus, a master,	<i>Sp.</i> don, duenna;
	<i>Fr.</i> dominate, dominion.
Dubitare, to doubt,	<i>It.</i> doubt;
Dubius, uncertain,	<i>Fr.</i> dubitation.
Donum, a gift,	<i>Lat.</i> dubious, dubiety.
	<i>Sp.</i> donation;
Ducatus, { a leading;	<i>Fr.</i> donative.
{ Med. Lat. a duchy }	<i>Fr.</i> duchy;
Factio, a making,	<i>It.</i> duke, doge.
Fragilis, easily broken,	<i>Fr.</i> faction, fashion.
Gravis, heavy,	<i>Fr.</i> fragile, frail.
Hospes, a host,	<i>Fr.</i> grave, gravity, gravitate.
	<i>Fr.</i> hospital, spital, hospitable.
Implicare, to fold in,	<i>It.</i> implicate;
	<i>Fr.</i> imply, implicit.
Ingenium, genius,	<i>Sp.</i> ingenious;
Magister, master,	<i>Fr.</i> engine.
Major, greater,	<i>Sp.</i> mister, mistress, master.
	<i>Fr.</i> major, majority, mayor.
Opera, work,	<i>Fr.</i> operate, operator, operation;
Pietas, piety,	<i>It.</i> opera.
Potio, drink,	<i>Fr.</i> piety, pity.
Redimo, to buy off,	<i>Fr.</i> potion, poison.
Romanus, Roman,	<i>Fr.</i> redeemed, redemption.
Securitas, security,	<i>Fr.</i> Roman, Romance.
Senior, older,	<i>Fr.</i> security, surety.
Salvo, I save,	<i>Fr.</i> sire, sir.
Separo, I put apart,	<i>Fr.</i> save, safe, salutary.
Servio, I serve,	<i>Fr.</i> separate, sever.
Species, a kind,	<i>Fr.</i> serve, servant, serf.
Superficies, a surface,	<i>Sp.</i> specie, species;
	<i>Fr.</i> special, especially.
	<i>Fr.</i> surface, superficies, superficial.

This list pretends to nothing more than to give instances in which two or more words accrued from one Latin term. In some instances it is not easy to determine whether our English word came immediately from the Latin, or through some one of the Romance languages. If, however, the facts above set forth are correct in the main, then we learn how much our language has been enriched by the Romance tongues, and that we are chiefly under obligations to the French.

Were this the place to enter into a statement and comparison of the words and forms in the Romance languages borrowed

from the Latin, we should be able to do much to enforce on our pupils the study of the Latin as the mother tongue, and as the key to the French, the Italian, the Spanish, and the Portuguese; nor do we doubt that the knowledge of comparative philology which, thanks to German scholarship, is now rapidly spreading over the civilised world, will ere long lead to what may be termed the genealogical study of languages. Instead of spending many years in learning some little Latin and less Greek, after the tedious and almost futile plan of our ancient grammar-schools, the young will be led to study languages in their natural groups: the Indo-European group; the Shemitic group; the Celtic group; and in subordinate classes, the Greek, the Latin, and the German group. With a good knowledge of Latin, which ought not to cost a boy above three years, a student, if rightly directed, could acquire the French, the Italian, the Spanish, and the Portuguese within two years, and at the same time receive great aid toward a minute and accurate knowledge of the English, especially if at the same time he was studying German together with its cognate tongues.

EXERCISES IN COMPOSITION.

Form each of the ensuing words into a sentence.

Words with their proper Prepositions.

	FOREIGN REPRESENTATIVES.
To call on, at, for, on a person;	<i>Lat.</i> cal, to call.
son; at a house,	<i>Lat.</i> cap, to receive.
Capable of,	
Care for,	<i>Sax.</i> car, solicitude.
Careful of, for,	
Careless of,	
Carp at,	<i>Lat.</i> carp, to pluck.
Catch at, up,	<i>Dut.</i> ketz, to catch.
Caution against,	<i>Lat.</i> caut, to guard against.
Certify of,	<i>Lat.</i> certus, certain.
Change for, with,	<i>Fr.</i> change, to change.
Charge on, or against a person;	<i>Fr.</i> charge, to load.
son; with a thing,	

Report the following anecdotes to another person, or write out your own version of them after having read them through carefully:—

A PARDON AT THE RIGHT MOMENT.

On the 29th of May, the whole garrison was paraded on the Castle Hill at Edinburgh, and formed in three sides of a hollow square, facing inwards. With drums muffled and rolling, while the band played a solemn dead march, three of the Highland recruits, each stepping slowly behind his open coffin, were brought by an armed escort down the winding pathway from the citadel, and placed in the vacant space of the square, opposite a numerous firing party under the orders of the provost-marshal. It was a bright and beautiful summer morning, but there was a dark cloud on every face, for no ceremony is more impressive and terrible than a military execution—and on that morning three soldiers were to die. They were desired to kneel down beside their open coffins, while the following paper was read by the adjutant-general:—

Garrison Orders.

Head-Quarters, 6th May, 1773.

“At a general court-martial, held in Edinburgh Castle, on Thursday, the 6th May, and two following days, whereof Lieut.-Colonel Dundas, of the 11th Dragoons, was president, for the trial of Charles Williamson and Archibald Mac-Ivor, soldiers of the 42nd Regiment, and Robert Budge, soldier of the 71st Regiment, accused of mutiny, at Leith, on the 20th April, and instigating others to do the same, the court unanimously found the prisoners guilty of mutiny, being a breach of the 1st, 2nd, 3rd, 4th, and 5th articles of war; and having duly considered the evil tendency of mutiny and sedition, especially when carried to such enormous lengths as in the present case, do adjudge you, the aforesaid Charles Williamson, Archibald Mac-Ivor, and Robert Budge, to be shot to death!”

The poor prisoners remained on their knees while a Highland officer translated the foregoing into Gaelic. They were all pale and composed but the last, who was suffering from severe wounds received at Leith; his countenance was emaciated and ghastly, and he was sinking from excessive debility. Their eyes were bound up; the officer retired; the provost-marshal approached, and ordered his party to load. They were in the act of taking aim at the prisoners, who were praying intently in Gaelic, when Sir Adolphus Oughton stepped forward, and, displaying three pardons, commanded them to “recover arms.” “Soldiers,” said he, “in consequence of the distinguished valour of the Royal Highlanders, to which two of these unfortunate men belong, His Majesty has been graciously pleased to forgive them all. Prisoners! rise, resume your arms, and re-join your companies.” An officer repeated these words in Gaelic. The scene and the whole proceedings were so solemn and affecting that the prisoners were incapable of speech. Raising their bonnets, they endeavoured to ex-

press their gratitude by a faint cheer, but their voices utterly failed them; and, overcome by weakness and a revulsion of feeling, the soldier of the 71st sank prostrate on the ground between the columns.—“*Memorials of the Castle of Edinburgh*,” pp. 257-259.

A WHALER IN A STORM.

About eleven o'clock, I ventured on deck, and for the first time in my life saw what the ocean looks like in a storm. I could see nothing all round but heaving mountains of water; each succeeding wave seemed as if it would swallow up the labouring vessel, but it always appeared to melt away gently under us, except when one more rapid, or “cross,” would send water and spray washing over her decks and high up into the rigging. The motion of the ship was not uncomfortable, being very different from the short cross-pitching we had experienced in the North Sea. I remained on deck about a quarter of an hour, gazing about me in silent wonder and admiration, little thinking that the hitherto harmless waves were upon the very eve of proving their might over man's puny bolts and beams. Feeling it chilly, I went below. I had just entered the cabin and taken my seat, when the ship became motionless, as it were, and seemed to tremble in every beam. A report, like thunder, mingled with the rending and crashing of timber; sudden and complete darkness, with a rush of water through the skylight, and the ship thrown on her beam-ends, showed me what one has to expect occasionally at sea. I scrambled on deck after the captain, as I best could, scarcely knowing what had happened. Here nothing was to be seen but wreck and destruction. The quarter-deck was literally swept of everything—rails and bulwarks, almost all the stanchions, the binnacle, the compasses, dog's couch—and nothing could be seen of the wheel but the nave. But the worst was still to come; two poor fellows were missing. One had perished unnoticed; he must have been killed amongst the wreck, washed overboard, and sunk like a stone. The other had been seen by the mate—for an instant only—floating on the binnacle and just sinking. No human assistance could have been rendered to them with such a sea running. Two other poor fellows were rather seriously injured, and took up my attention for some time. The captain, cool and collected, soon restored confidence to his men, and, in a short time, had the wreck cleared away, a long tiller shipped, and the vessel again hoisted. Spare spars were lashed to the stanchions that remained, so that we had again something like bulwarks, but for many a day afterwards the ship had a sadly-damaged and wrecked appearance.—*Goodsir's Arctic Voyage*.

HISTORIC SKETCHES.—XXVIII.

HOW IRELAND BECAME PART OF GREAT BRITAIN.

PART II.

In May, 1169, Robert Fitz-Stephen, accompanied by Hervey de Montemarisco, a relative of the Earl of Pembroke, and by 30 knights, 60 men-at-arms, and 300 archers, landed in the creek Bann, near Wexford, and were the first Anglo-Normans that had appeared in Ireland as invaders. They were immediately joined by Maurice de Prendergast, a Welsh knight, with 10 men-at-arms and 60 archers. Dermot, with 500 men, all he could collect, hastened to meet them, and the united forces, numbering not more than a thousand men, instantly marched upon Wexford, which capitulated after making a fair show of resistance. From Wexford, Dermot took his friends to Ferns, where they rested three weeks, the Irish princes taking no steps to molest them, or to delay their progress; and from Ferns they went on a marauding expedition into Ossory, to allow of Dermot revenging himself on Mac-Gilla-Patrick, prince of the district, who had caused the eyes of Dermot's son to be rooted out. Ossory was ravaged with fire and sword, the bravest exertions of the people being of no avail against disciplined and armour-clad troops.

At Tara, Roderic O'Connor convened a council of all the Irish princes, and marched thence with a large but tumultuous army to Dublin. At Dublin, divisions sprang up among the chiefs, some of the most powerful of whom withdrew themselves from the league and went home.

Dermot entrenched himself at Ferns, being assisted by the skill and science of his Anglo-Norman allies; and when Roderic came with forces outnumbering the strangers by about thirty to one, he found himself unable to act on the offensive against them. He tried negotiation with Dermot, and with the English commanders separately, endeavouring to detach them from each other by appeals to their respective interests. But the confederates compared notes, and the treachery of Roderic returned edgeways into his own bosom. He was compelled, in spite of his great army, to make terms with the rebel, to promise him recognition as sovereign prince of Leinster, and to do the like

by his heirs afterwards. Dermot was left free to follow his own inclinations, and he accordingly marched with his allies, reinforced by Maurice Fitz-Gerald and a small following, to Dublin, which had thrown off its duty to him, and which was now made to pay by rivers of blood for its temerity, being only saved from utter destruction by the wish of Dermot to turn his arms northward, where the King of Munster was fighting on unequal terms with O'Connor of Connaught.

Allying himself with the King of Munster, Dermot drove Roderic back into his own dominions, and finding himself so strong, resolved to set up a claim to be sovereign of all Erin. At this juncture Raymond Le Gros, in command of the vanguard of the Earl of Pembroke, arrived at a place near Waterford, and being joined by Hervey de Montemarisco, succeeded in establishing himself in a fort near Waterford. Three months afterwards the Earl of Pembroke himself, in spite of a positive order from his king—which reached him at Milford Haven as he was about to embark, and which forbade him to proceed—came over to Waterford with 200 knights and 1,000 archers.

Raymond le Gros joined his master, and the earl, knowing that if he wanted to justify by success his disregard of King Henry's orders, he must lose no time in setting to work, gave orders for an immediate attack on Waterford. The city was carried by assault, and then Dermot came, and gave the earl his daughter Eva in marriage then and there.

It were long to trace out step by step the history of the English campaigns in Ireland, before Henry II. himself came over and assumed the lordship of the country; to show how St. Laurence O'Toole, Archbishop of Dublin, rallied for a time the numerous Irish princes round the national standard, and how his exertions were nearly rewarded by the destruction of all the invaders; how the English adventurers suffered many things at the hands of the Irish, and how they saved themselves by the exhibition of a desperate and splendid courage. It is sufficient for the present purpose to say that Strongbow, having in the summer of 1171 gone over to England, and made his peace with Henry at the price of surrendering to him all sovereign rights and all the ports and fortresses in Ireland, returned with his monarch, who, being now free from the disquietude which had before troubled him, gave his whole attention to achieving the conquest of Ireland. On St. Luke's Day, the 18th October, 1171, Henry landed at the Crook, near Waterford, with 500 knights and 4,000 men-at-arms. Some show of resistance was made in one or two places, but it was feeble and useless against the numbers and discipline of the English troops. Prince after prince gave in his adhesion, swore fealty to Henry, and was admitted his liegeman, so that the English monarch's progress was one of continued triumph; and when, on Christmas Day, he kept his court in Dublin, his table was filled with Irish chieftains who had hitherto maintained a perfectly real independence, only doubtfully confessing the superiority of the titular Irish king.

There can be little doubt that, if Henry had had time to consolidate the power he had acquired in Ireland, he would have settled his grasp on the island with very little trouble; but unfortunately, perhaps, for Ireland, he was suddenly recalled in the spring of 1172, on account of the proceedings taken against him for his alleged part in the death of Thomas à Becket. On the 17th of April, 1172, he sailed from Waterford, after having arranged for the government of his new kingdom, and having appointed various noblemen of his army to posts of command. The laws of England were also imposed on the realm of Ireland.

Never before, and perhaps never since, had Ireland enjoyed a quieter and more contented time than during the six months after Henry's departure. The strength of the English kept the Irish from interfering with them, and their far-reaching power even restrained the Irish from internecine war. The land breathed again, and all went well till the restless spirit of the Irish, not enduring the presence of strangers, broke out again in armed resistance. The fortune of war gave the advantage now to this side, now to that, and at one time it seemed as if the work of conquest in Ireland would have to be done all over again; but in the end the root which had been planted spread abundantly, and by a treaty made between Henry and Roderic O'Connor, it was agreed that the latter should be king over all Ireland, except about one-third, which was given to the English (it was afterwards called the Pale), and that he should do homage for the same, receiving in return the homage of all the lesser Irish princes. An arrangement of this sort was fruitful

in disturbances; the English encroached upon the Irish, the Irish ever sought to oust the English, and bloodshed, rapine, and misery were made part of the natural order of things. The only way, at length, in which the island could be governed, if held by the English at all, was by means of a military governor, armed with large discretionary power; and this system of government was adopted from the time of Strongbow till quite modern times, the idea of the ruling power being, not to do what was best for the interests of the governed, but to secure the conquest which had been made.

Government conducted on this principle, or rather on this want of principle, could have but one result—discontent with, and hatred for, the dominant power. Whenever an opportunity presented itself, whenever the oppression of the government, or the yet more insufferable insolence of the foreign settlers, became too unbearable, rebellions broke forth; and though they did not succeed in breaking the yoke from off the necks of the rebels, they involved the country in such confusion as to make it a thorn and a trouble in the side of England, and English governors and statesmen, it is to be feared, looked rather to the plucking out of the thorn than to remedying the causes which led to that thorn being pricked into her. Here are words written by Edmund Spenser, the poet, in Elizabeth's time, in his "Views of the State of Ireland," words which, for their vigour and apt relation to the case, might have been written at a much later date:—"There have bin divers good plottes devised, and wise counsels cast already about reformation of that realme; but they say it is the fatal destiny of that land, that no purposes whatsoever which are meant for her good wil prosper or take good effect, which, whether it proceed from the very genius of the soyle, or influence of the starres, or that Almighty God hath not yet appointed the time of her reformation, or that hee reserveth her in this unquiet state still for some secret scourge, which shall by her come unto England, it is hard to be knowne, but yet much to be feared." And thus Spenser answers his own questions:—"Surely I suppose this but a vaine conceipt of simple men which judge things by their effects and not by their causes: for I would rather thinke the cause of this evil, which hangeth upon that country, to proceed rather of the unreasonnes of the counsels and plotts, which you say have bin oftentimes laid for the reformation, or of faintnes in following and effecting the same, than of any such fatal course appointed of God, as you misdeem; but it is the manner of men, that when they are fallen into any absurdity, or their actions succcede not as they would, they are always readie to impute the blame thereof unto the heavens, so to excuse their owne follies and imperfections."

The "good plotts and wise counsels" above referred to were either not appreciated by the Irish, or—and this is closer to the truth—they were devised so much in the selfish interests of the English and so little in the interests of the Irish, that the latter would have none of them, and, as has been said, they rose in rebellion on every favourable occasion. Under Henry III., in rebellion on every favourable occasion, their uprisings under Elizabeth, under James I., and Charles I., their uprisings were general and most formidable, requiring the whole strength of England to crush them, though it did not at the same time crush the almost universal discontent. Not until Oliver Cromwell himself took the military command in Ireland could the country ever have been said to be thoroughly subdued; and the manner in which he behaved there, following out to this day most the traditional English policy, is remembered to this day with dread and a shudder, and the Irish peasant can wish as worse curse to fall upon the head of an enemy than the "curse of Cromwell." He marched right through the country, conquering all before him, scarcely forgiving those who did not resist him, slaughtering without mercy all who dared to oppose his arms. Whole garrisons were put to the sword, and Ireland, blinded with the blood of her children, remained for a while at rest, unable to move, pressed down by the iron heel of the mighty warrior who had bound the Kings of England and Scotland with chains, and their nobles with links of iron. Then came William III., pursuing into Ireland his father-in-law, the English throne under the title of James I. Mar. 24, 1693. Scotland declared in Union with the English Commonwealth by Cromwell. 1691.

severely embittered the relations between Protestants and Roman Catholics, grew fiercer, and rendered the struggle more and more desperate.

Not until after the lamentable rebellion which took place in 1798, and which was assisted by the French, then struggling by any means to inflict mortal injuries upon Great Britain, did English statesmen see the propriety and the wisdom of doing "justice to Ireland." The immediate political result of this rebellion, which was not put down without much bloodshed both on the field and on the scaffold, was the union of Ireland with the sister kingdom, and this act was consummated, under the auspices of Mr. Pitt, on the 1st of January, 1801. Before that date Ireland had borne to England the same sort of relation that Hungary till lately bore to Austria; she was a separate kingdom, though acknowledging the same king, had a separate Parliament of two Houses, and was, as far as her own internal affairs went, distinct from Great Britain. But it was found that the Parliament was steeped in corruption to the lips, that selfish interests selfishly advocated were alone represented in it, and that the few brilliant statesmen, properly so called, whose voices from time to time were heard in it, were borne down by the dead weight of those who saw no use in legislating for the real good of the people.

Mr. Pitt, therefore, in view of this state of things, and recognising that the Irish people had many veritable grievances to be redressed, determined to bring about a union between the countries. In the face of much opposition, and under circumstances of much public danger, he carried his point, and in January, 1801, the Irish Parliament, by its own consent, ceased to exist. Since that time Irish interests have been represented by 105 members sitting in the imperial House of Commons at Westminster, and the peerage of Ireland by 32 representative peers, including four ecclesiastics, in the House of Lords. Since that time also Irish interests have been more conscientiously considered than before, and legislation, of which the distinct object was to do justice to Ireland as an integral part of the empire, has gone forward with a quick hand. There is now no reason whatever why, in the face of equal laws faithfully administered, the kingdom of Ireland should not be as really and intimately united to the sister kingdom of England, as Scotland or Wales; why the memory of old wrongs and old quarrels should not be buried for ever, or why the three countries should not be as inseparable as the leaves on the shamrock, the three-in-one plant, by which St. Patrick is said to have made plain to the Irish the mystery of the unity of the Blessed Trinity.

PRINCIPAL OCCURRENCES IN THE CHAIN OF EVENTS THAT LED TO THE UNION OF SCOTLAND AND IRELAND WITH ENGLAND.

SCOTLAND.	LEGISLATIVE UNION OF ENGLAND AND SCOTLAND AS THE KINGDOM OF GREAT BRITAIN.
Contention of John Balliol and Edward Bruce for the crown 1291	May 1, 1707
Edward I., called in as umpire, decides the dispute in favour of Balliol . . . 1292	
Balliol dethroned by Edward I. 1296	
Rising of the Scotch under Sir William Wallace . . . 1297	
Wallace captured by treachery 1304	
Exiled at Smithfield, Aug. 23, 1305	
Robert Bruce crowned King of Scotland . . . 1306	
Battle of Bannockburn, June 25, 1314	
Alliance between the Royal Families of England and Scotland by the marriage of James IV., and Margaret, daughter of Henry VII. Aug. 8, 1503	
Battle of Flodden Field and death of James IV. Sep. 9, 1513	
Erk of James VI., the great-grandson of James IV. 1566	
Accession of James VI. to the English throne under the title of James I. Mar. 24, 1603	
Scotland declared in Union with the English Commonwealth by Cromwell . . . 1691	
	IRELAND.
	Adrian IV. gives permission to Henry II. of England to invade Ireland and hold it as a fief of the Church . . . 1156
	Dermot MacMurchad, King of Leinster, takes refuge in England . . . 1168
	Landing of Fitz-Stephen to assist Mac-Murchad . . . 1169
	Landing of Strongbow . . . 1170
	Henry II. lands near Waterford, and, receiving the submission of the Irish princes, becomes "Lord of Ireland" . . . Oct. 18, 1171
	English Laws, etc., introduced by King John . . . 1210
	Piers Gaveston, first Lord-Lieutenant of Ireland . . . 1308
	Richard II. in Ireland . . . 1394
	Apparel and Surnames Act . . . 1465
	Poyning's Law passed . . . 1494
	Rebellion of the Fitzgeralds . . . 1534
	Henry VIII. assumes the title of "King of Ireland" . . . 1542

IRELAND—continued.	
Insurrection of Tyrone . . . 1601-2	
Settlement of Ulster in the reign of James I. . . 1690-12	
Massacre of the Protestants in Ulster . . . 1641	

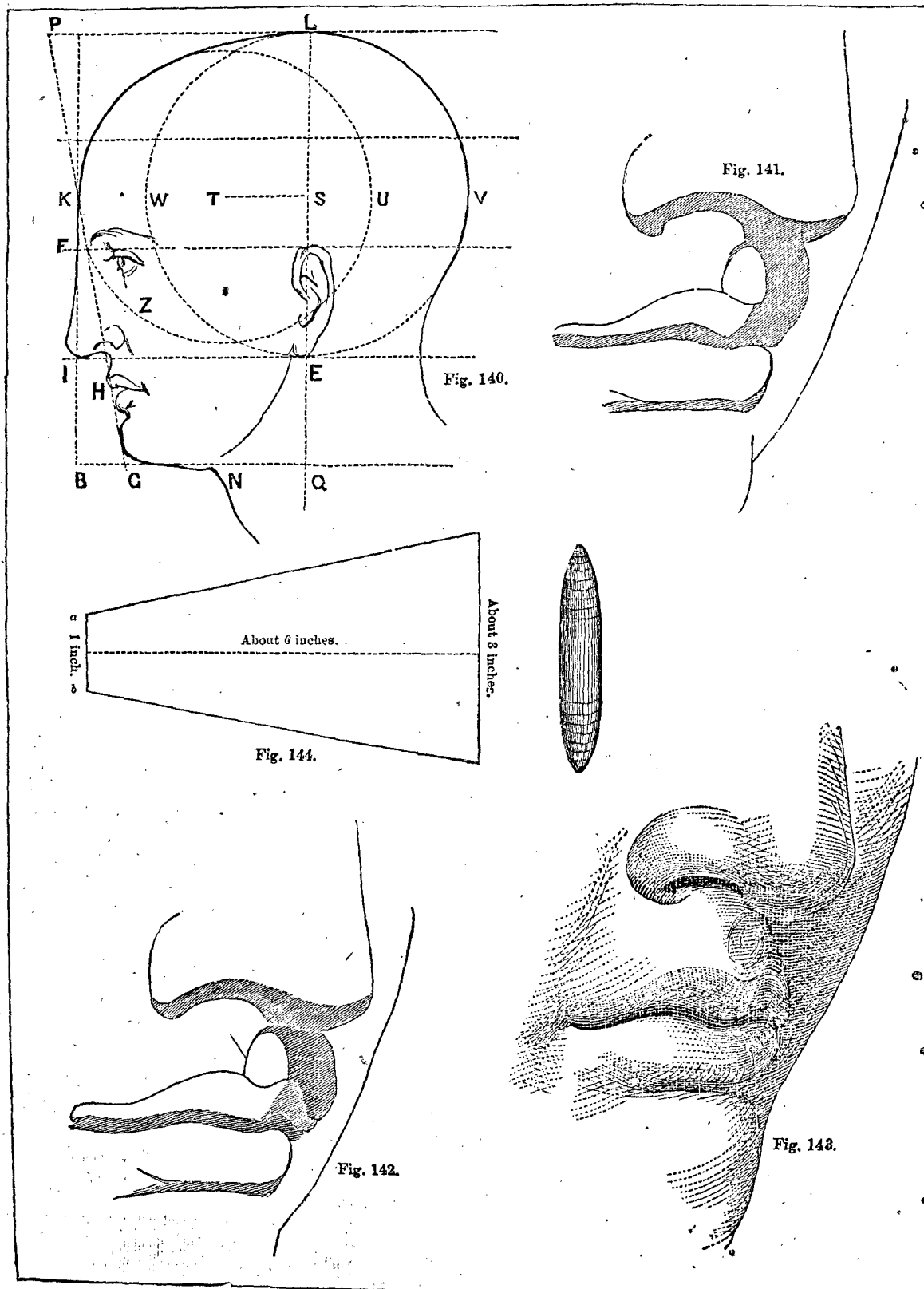
Cromwell enforces obedience throughout Ireland . . . 1649-56	
William III. in Ireland . . . 1690	
Great Irish Rebellion . . . 1798	
Legislative Union of Great Britain and Ireland Jan. 1, 1801	

LESSONS IN DRAWING.—XXIII.

THE second use of the oval is when the axis is horizontal; and here we cannot do better than quote the observations of Professor Camper, who, after saying he had attentively examined the structure of the skulls of both adults and infants, proceeds thus:—"An idea suggested itself that in drawing the head, the best method would be to imitate the process of nature: first to form the cranium or skull, then mark the facial line in the direction required, and afterwards arrange the other parts according to given proportions."

"The skull is a horizontal oval, of which the hindermost parts are the largest, and the fore part like the section of a globe. I first draw this oval by means of two circles; the one is L V E W (Fig. 140), which contains about three parts of the head; the other, X U Z, which is in size eight-ninths of the other circle. Draw the horizontal line S T, which extends from the centre of the large circle S, to T, the centre of the smaller, and is one-fourth of the larger circle. From the centre S, I let fall the perpendicular line S Q; this marks the seat of the orifice of the ear, and its lobe E." Upon examining the drawing the Professor gives (Fig. 140) to illustrate his remarks, we find a discrepancy which we think it right to notice. The diameter of the smaller circle is eight-ninths of the diameter of the larger circle; also the distance between the two centres T and S is one-fourth of the diameter of the larger circle; as it is written, the areas of the circles might be supposed to be intended. The Professor continues—"I draw, P Q, the facial line, in the degree of the inclination required; K marks the place of the forehead; F, the line of the eye; I, the nose; H, and a third of I B or I G, the mouth; through the centre of L Q I draw the horizontal line F; I also make G N equal to the nose, and from N commence the line of the throat." This idea of Professor Camper is worth considering; it may be useful, as the principle it involves is in accordance with that of nature, and after a little practice of drawing the oval by hand, the features and other parts may very easily be put together. But we must observe that this method is applicable only to profiles; where the first method so far fails in not giving the horizontal projection of the hinder part, although in all other positions it may be useful. Consequently, it is well to know both, so that one may be used in the one case, and the other in the remainder. After all, the great advantage connected with these two methods of employing the oval is the certainty of securing the general form of the head, the proportions of the parts, and the positions of the features in connection with each other. Beyond these, as regards the details, we cannot venture; the draughtsman must not be controlled by them; he must make them subservient to his purpose according to the character of the head he is drawing.

The next portion of our subject will be the method of shading. A very great deal is included in this. In the first place, the pupil must have acquired confidence in drawing an outline, as he will soon find that the difficulties of shading do not exist so much in the manipulation—that is, in the manner of doing it—as in the application of the work. In the second place, nothing contributes more effectively in describing the form of an object than the proper treatment of the shades and the semitones; and especially with respect to the human figure, where on the surface, between the extreme boundary lines, is always found an amount of form which it would be impossible to represent faithfully by outline only. For example, the form of the nose in a side face is very easily given by the outline; but when the same face is turned to a front view, then we have to depend upon our capability of representing the form by light and shade. The same remarks are applicable to the treatment of the surfaces of the body and limbs; for as they are constantly subject to change, in consequence of the variety of motion of which they are capable, there will always be a considerable demand upon our anatomical knowledge, if we hope to deal faithfully with the ever-varying surface as it approaches the eye, or recedes to the boundary represented by line only. Therefore the know-



ledge we speak of must help us to use the shade tints in such a way that the muscles and bones which give the variety of surface may be exactly represented in accordance with the action and strength the parts exhibit.

The manner of using the pencil in shading has been already explained in Lesson XII. (Vol. I., page 359). The pupil must refer to this again, and continue the practice. It would be advisable to procure a ball about the size of a cricket-ball (this kind of ball, indeed, would answer the purpose), whitewash it, and when dry it will form an excellent model from which the practice of shading may be studied with advantage; for the ball exhibits every degree of light and shade, from the highest light to the darkest shadow, including the cast shadow upon the table or stand upon which it is placed. Figs. 141, 142, and 143 are given to illustrate the course to be pursued. After the outline has been made, if it should be black or heavy, faint it. A light outline is the best to proceed with in the shading. A black outline upon the edges of the shadow injures them very much; it destroys the harmony of tone, and, what is very objectionable, the eye is attracted by it. We are obliged to make use of a line to determine the extent of the part, and its subdivisions which contain the extent of tone or colour, and we must have no mean consideration of its importance, but as we proceed with the work, the line must be absorbed in the shadows. Nature shows no black outline but a *limit*; we draw the limits by clear faint lines, and complete the effect by shading. It must be borne in mind that we have only two means of distinguishing objects from one another—by light and shade, and by colour; consequently, when Nature begins to use black lines to mark her boundaries, we may. Mark in slightly, but with great care, the extent of the broad and cast shadows. In order to understand clearly the extent of these shadows, and to decide where the half-tint commences, and the depth and proportion of all other minor tones, the pupil must look at his copy or model for a moment or two with half-closed eyes; he will very soon see the advantage of doing so, as he will thereby be able to say which is decided shadow and which are the half-tints, and thus at once determine the proportion of tone he is to employ in representing them. The first stage will be to fill in the whole of the broad and cast shadows with one flat even tint, equal in tone to the reflections, as in Fig. 141; afterwards darken the greatest depth by crossing lines, lifting up the pencil as explained by Fig. 83, Lesson XII. (Vol. I., page 360); then lastly will be the semitones connecting the high lights and broad shadows, with all those minor tones found within the limits of the broad light, and caused by the varied surface of the object (Fig. 142). The stump mentioned in Lesson X. (Vol. I., page 295) may be used to lay on a flat and moderate tint over the parts intended for the broad and cast shadows; afterwards work over the shadows with the point in the *line manner*. The use of the stump must be restricted to the shadows named until the pupil has acquired confidence in handling it, and then he will find himself capable of employing it for the darkest of the minor tones, but in this he must be guided by his own judgment, resulting from experience. Perhaps some of our pupils may be unable readily to procure a stump; we will show them how to make one. Cut some thick coarse grey packing-paper to the shape of Fig. 144, according to the dimensions there given; and then roll it closely up, beginning at the broader end, and terminating with *a b*. If the stump be well made it will be very hard and tight, ending in a point at both ends. Put a little gum on the end *a b*, and press it down upon the body of the stump; it will then be fit for use, as follows:—Take a piece of hard strong paper, and cover a portion of it with a HB pencil until it is quite black; then rub the end of the stump on the blackened paper, and tone down the shadows with it as evenly as possible. Another hint with regard to the outline. It frequently happens that, by repeated alterations, the surface of the paper loses its firmness and becomes dirty, so that, when shading upon it, it is very difficult to make a clean and bright drawing; therefore finish the outline regardless of the paper, and trace it upon a clean piece to receive the shading. The tracing-paper may be made by rubbing a dark and soft pencil upon half a sheet of foolscap. Place the clean paper to receive the shaded drawing upon a drawing-board; upon this place the tracing-paper laid upon its face downwards; and lastly, the finished outline upon that; pin them down at one end, and then, with a hard point, firmly press over the outline, which will be printed upon the clean

sheet from the blackened paper; this traced outline will then be ready for shading.

Until the pupil has had some considerable practice, he will find that his greatest difficulty does not consist in making an even tint, as all defects can be remedied by stippling—that is, by carefully filling up the lighter or uneven parts with the point only; but it consists in uniting the extreme lights with the decided shadows by semitones, which are liable to appear dirty, and require a very careful and delicate hand to treat them properly.

To sum up, we have in these lessons taken up the three leading divisions of art—*still life*, *landscape*, and *figure*—and have endeavoured to give the necessary instructions which are generally applicable to all, at the same time paying due regard to particulars which belong to and sustain the individual character of each subject as it comes before us. Our pupils will have discovered that the leading principles of art are universal, that they are not confined to one particular branch to the exclusion of others; but from the moment we take up the pencil to commence the outline, the essential beginning of *every* subject, we start upon principles which are absolute, and which must have their influence in directing us. This refers to the drawing or outline preparatory to filling it in with light and shade or colour. There is no necessity to repeat the cautions we have given, or the necessary process of execution, when engaged in this most difficult and most important part of the work. Our efforts should be to acquire a bold and unhesitating manner of drawing; this can only be done by a thorough knowledge of the subject and close observation, combined with patience and perseverance. A bold, free style is frequently understood to be a rapid dashing manner, a fatal mistake in hundreds of cases where study and experience have had but little influence. Bold drawing is done with few lines and seemingly little effort, in a quiet, deliberate, and steady manner, producing a resemblance which is recognised, felt, and admired by all who are interested in it. Success of this kind is not altogether the result of manual practice, the mind has the most to do with it; the knowledge of things in general, of facts relating to natural history, manners and customs, and the character and construction of the object we are representing, are the greatest means of help we can obtain. A mind thus thoroughly instructed will have much less difficulty in guiding the hand than when it is dependent upon manual practice only; because, if the mind can fully comprehend that which has to be done, and can within itself see the result, the hand well practised in the manner of wielding the pencil will at once be guided by its influence, doubts and speculations will be few, and the result satisfactory. It is not at all uncommon to meet with the case of a draughtsman or artist satisfied with a picture, at which a man with an accomplished mind only smiles. Why is it? Simply because the painter has depended more upon his hand than his judgment, or that his mind is incapable of receiving those more important lessons from Nature which elevate art and make it valuable. Of course we feel we are addressing those who cannot remain satisfied with bare imitation, whose desire is to do something more, and picture the life as well as the form. The instructions necessary for imitation only are very simple, and can soon be explained, and we trust we have not failed to do so; but beyond that point the sources of instruction are infinite, as every object has something to reveal concerning itself, and the artist must not fail to listen to it.

We will conclude with a passage from one of the lectures of Sir Joshua Reynolds, delivered to the students at the Royal Academy:—"There is one precept," he observes, "in which I shall be opposed only by the vain, the ignorant, and the idle. I am not afraid that I shall repeat it too often. You must have no dependence on your own genius. If you have talents, industry will improve them; if you have moderate abilities, industry will supply their deficiency. Nothing is denied to well-directed labour; nothing is to be obtained without it. Not to enter into metaphysical discussions on the nature or essence of genius, I will venture to assert that assiduity, unabated by difficulties, and a disposition eagerly directed to the object of its pursuit, will produce effects similar to those which some call the result of natural powers. Though a man cannot at all times, and in all places, paint or draw, yet the mind can prepare itself by laying in proper materials, at all times and in all places."

LESSONS IN GERMAN.—XXXVII.

SECTION LXXII.—PASSIVE VERBS IN THE SUBJUNCTIVE. (§ 85.)

VOCABULARY.

Abbrechen, to break off, crop, pluck.	Dafür halten, to be of opinion, to deem.	Klagen, to complain, lament.
Auffallend, startling, striking, remarkable.	Darstellen, to present, offer.	Lösen, to solve, unriddle.
Anrufen, to call out.	Ehren, to honour, respect, esteem.	Orakel, n. oracle.
Außere, n. countenance, exterior.	Einnehmen, to occupy, take possession of.	Räthsel, n. riddle, enigma.
Befürchten, to fear, apprehend.	Fortschleppen, to drag, pull along.	Spiel, n. game, play.
Begnadigen, to pardon, favour.	Graben, to dig, grub, ditch.	Troja, n. Troy.
Beifügen, to bite.	Griechisch, Greek, Hellenic.	Uebertreiben, n. excess, superfluity.
Bestrafung, f. garri-son.	Hinterlegen, to de-ceive, delude.	Ueberrücken, as for the rest, besides.
Bestrafung, f. corrup-tion, bribery.	Hinsetzen, to de-ceive, delude.	Verfügen, to an-nounce, predict.
Carthago, n. Carthage.	Hinsetzen, to de-ceive, delude.	Vermuthen, to sup-pose, presume, think.

RÉSUMÉ OF EXAMPLES.

Er wollte nicht erlauben, daß jener Mann getreten werde.	He would not allow that that man should be called.
Sie hatten vergebens gehofft, daß die vielen kleinen Herzogthümer in Provinzen eingetheilt würden.	They had vainly hoped that the many little dukedoms would be divided into provinces.
Man glaubt, daß bei diesem letzten Sturm viele Schiffe vertrieben worden seien.	It is supposed that, by this late (last) storm, many vessels have been cast away.
Er erzählte mir, daß meine Abhandlungen über diesen Gegenstand sehr gelobt worden wären.	He told (Sect. LXXXII. 1) me that my dissertations concerning this affair had been very much lauded.
Da die fürstliche Familie gegenwärtig ist, so vermuthet man, daß diesen Abend ein großes Concert werde gegeben werden.	Since the princely family is present, it is conjectured that a great concert will be given this evening.
Ich hoffe, daß in kurzer Zeit alle Hindernisse von ihm werden überwunden werden sein.	I hope that in (a) short time all hindrances will have been surmounted by him.

EXERCISE 138.

1. Es wird gesagt, daß der Schauspieler eine Vorstellung gebe. = Es wird gesagt, daß eine Vorstellung von dem Schauspieler gegeben werde. 2. Der Nachbar glaubt, daß der Knabe seine Eltern täusche. = Der Nachbar glaubt, daß die Eltern von dem Knaben getäuscht werden. 3. Die Kinder sagten, der Jäger schiffe den Fisch. = Die Kinder sagten, der Jäger würde von dem Jäger geschiffen. 4. Man befürchtet, der Hund beiße die Leute. = Man befürchtet, die Leute würden von dem Hunde gebissen. 5. Man vermuthet, der Freund habe den Freund hintergangen. = Man vermuthet, der Freund sei vom Freunde hintergangen worden. 6. Der Vater meinte, daß die Kinder das Stück gespielt hätten. = Der Vater meinte, daß das Stück von den Kindern gespielt worden wäre. 7. Er erzählte mir, daß die Blumen in seinem Garten abgebrochen hätten. = Er erzählte mir, daß die Blumen in seinem Garten von den Mädchen abgebrochen worden. 8. Der alte Soldat rief aus, daß er keinen Gefährten nie von ihm werde vergessen werden. = Der alte Soldat rief aus, daß sein Gefährte nie von ihm werde vergessen werden. 9. Die Mutter sagte, es werde diesen Nachmittag im Garten von ihr gegraben werden. = Die Mutter sagte, es werde diesen Nachmittag im Garten von ihr gegraben werden. 10. Ich möchte wissen, ob Sie ihn würden geest haben. = Ich möchte wissen, ob er von Ihnen würde geest worden sein. 11. Ich dachte nicht anders, als daß er das Spiel würde gewonnen haben. = Ich dachte nicht anders, als daß das Spiel von ihm würde gewonnen werden sein. 12. Das Orakel verkündigte ihm, er werde siegen. 13. Er sagte mir, er werde von Jetermann geliebt und geachtet. 14. Er behauptet, das Räthsel sei durch ihn gelöst worden. 15. Die Geschichte meinet, daß Treja von den griechischen Fürsten zerstört worden sei. 16. Er sagte ihm, er würde seinetwegen (Sect. LXXXIII. 1) Alles zu thun bereit sein. 17. Der Freund behauptete, daß er so wenig von mir bestraft würde. 18. Man sagt, Ungarn sei durch Befriedung, nicht durch Gewalt der Waffen besetzt worden. 19. Mein Nachbar sagte mir, das Äußere dieses Mannes biete nichts Auffallendes dar, aber seine Seele wäre geziert durch eine Menge trefflicher Eigenschaften. 20. Der alte Cato schloß eine jede Rede mit den Worten: Uebriqens habte

ich dafür, daß Carthago zerstört werden muß. 21. Man vermuthet, die Bestung sei von den Scythen eingenommen worden, allein die Befragung werde begünstigt werden sein. 22. Der Jüngling sagte, es werde nach Vieles von ihm gethan werden. 23. Der betrubte Vater glaubt, sein Sohn werde von dem erbitterten Feinde erschossen werden sein. 24. Die Brautin behauptete, daß das Unglück durch die Schuld des Nachbarn herbeigeführt worden wäre. 25. Der Arme klagte, daß er gewaltsam fortgeschleppt worden wäre.

EXERCISE 139.

1. It was said that everybody would love those children. = It was said those children would be loved by everybody. 2. The teacher believes that the scholars could have learned their exercise. = The teacher believes that the exercise could have been learned by the scholars. 3. The gardener said he would dig tomorrow in the garden. = The gardener said it would be dug by him to-morrow in the garden. 4. We wish that you may love and esteem your friends. = We wish that your friends may be loved and esteemed by you. 5. We believed not that we should ever have been praised by our teachers, and that we should have satisfied them in everything. 6. It is impossible that you could have received the intelligence before us, except it might have been communicated to you by telegraph. 7. How is it possible that this undertaking could have been finished by you? 8. We doubt very much that we can ever be rewarded for our troubles, and that the promises can ever be fulfilled. 9. How could it be possible that that people was governed badly, when it had so wise and good a prince? 10. The poor slave complained that he had been forcibly dragged along, and in the excess of his grief he cried out, "Oh, that I had never been born!"

SECTION LXXIII.—IDIOMS OF PREPOSITIONS.

The preposition *wegen* is often compounded with the genitive of personal pronouns (§ 57. (2)), which in this connection substitute *t* or *et* for the final *r*; as:—*Wegenwegen* (instead of *meiner wegen*), on my account, for my sake (literally, on account of me). *Einwegen* nur *ein* ich gekommen, on his account only have I come.

1. The preposition *zu* is often used after certain verbs (as, *machen*, *meinen*, *wählen*, etc.) to mark the result of an action, or the end or destination of a thing; as:—*Sie haben ihn zum Feind gemacht*, you have made him (to) an enemy, or, you made an enemy of him. *Das Eis wird zu Wasser*, the ice becomes (to) water. *Sie wählten ihn zum Kaiser*, they elected him (to the) emperor.

2. *Verdacht* auf Jemand haben, or, Jemand im Verdacht haben (literally, to have suspicion upon one, or, to hold one in suspicion) answers to our "to suspect"; as:—*Ich habe Verdacht auf ihn*, or, *ich habe ihn im Verdacht*, I suspect him, or, I have suspicion of (upon) him.

VOCABULARY.

Ankleiden, to dress, attire.	Krankheit, f. sickness, illness, malady, disease.	Verdacht, m. suspi-cion.
Aufwärterin, f. female servant, waiting-woman.	Mittag, m. noon, mid-day.	Weiter, farther, more distant.
Ausziehung, f. consumption.	Mitternacht, f. mid-night.	Werfen, to throw, cast.
Baden, to bathe.	Speisen, to eat; zu Mittag speisen, to dine.	Werauf, whereupon, on which.
Brüßeln, to break-fast.		Zuerst, at first, for the first.

RÉSUMÉ OF EXAMPLES.

Haben Sie gehört, an was für einer Krankheit der Reisende gestorben ist?	Have you heard what disease the traveller (has) died of?
So viel (Sect. XXXIV. 4) ich weiß, ist er an der Cholera gestorben.	As far as I know, he (has) died of the cholera.
Alexander der Große starb an einer Krankheit zu Babylon im drei und dreißigsten Jahre seines Lebens.	Alexander the Great died of (a) sickness at Babylon in the thirty-third year of his life.
Auf wen haben Sie Verdacht?	Whom do you suspect? (Upon whom have you suspicion?)
Ich habe ihn im Verdacht, mich beraubt zu haben.	I suspect him of having robbed me. (I have him in suspicion to have robbed me.)
Nachdem ich zu Nacht gespeist habe, gehe ich aus.	After I shall have supped I shall go out. (After I shall have eaten at night, I go out.)

Er ist nach zehn Uhr zu mir gekommen. He came to me after ten o'clock. (He is come to me after ten o'clock.)

Er ist wegen seiner Krankheit nicht gekommen. On account of his illness he did not go. (He is on account of his illness not gone.)

EXERCISE 140.

1. Wissen Sie nicht, an was für einer Krankheit Ihre Nichte gestorben ist? 2. So viel ich gehört habe, ist sie an der Malaria gestorben. 3. Viele sind in diesem Jahre an der Cholera gestorben. 4. Weiß man nicht, wer die silbernen Teller gestohlen hat? 5. Nein, aber man hat Verdacht auf einen Bedienten des Hauses. 6. Man hatte zuerst eine alte Aufwärterin im Verdacht. 7. Er hat mich im Verdacht, ihn verächtlich behandelt zu haben. 8. Ich weiß wirklich nicht, auf wen ich meinen Verdacht werfen, und worauf ich ihn stützen soll. 9. Nachdem ich mich angekleidet, und nachdem ich frühstückt habe, werde, will ich ihn besuchen. 10. Nachdem er zu Mittag gespeist hatte, las er die Zeitung. 11. Nachdem er sich gebadet hatte, machte er einen Spaziergang. 12. Nach zehn Uhr des Abends besuchte er mich noch. 13. Nach Mitternacht werden wir unsere Reise weiter fortsetzen. 14. Es giebt Menschen, welche nach diesem Leben kein anderes erwarten. 15. Ich freue mich sehr, weil ich mehr, als meinethwegen. 16. Ihretwegen habe ich die Reise unternommen. 17. Guretwegen ist der Vater so betrubt. 18. Unsetwegen brauchen Sie sich nicht zu schämen. 19. Mein Bruder war seiner selbst nicht mehr mächtig. 20. Hast Du Herrn M. selbst, oder seine Frau gesehen? 21. Ich habe ihn selbst nicht nur gesehen, sondern auch gesprochen. 22. Ein treuer Soldat stirbt lieber, als daß er zum Verräther wird.

EXERCISE 141.

1. Are we obliged to wait for our friend? 2. No, not on his account. 3. This man is detested on account of his perfidy. 4. Do not grieve on account of us! 5. On my account you may do what you like. 6. My brother died of consumption in the nineteenth year of his age. 7. Do you know who has stolen your gold watch? 8. No, but I am suspicious of that man who came to our house yesterday. 9. At first I suspected a servant of the house. 10. After I had performed my last voyage, I applied myself to the study of the living languages. 11. After we had dined, we took an airing on horseback. 12. After he had breakfasted, he visited his brother-in-law. 13. This lady wants eighteen ells of muslin for a dress. 14. That youth became a doctor. 15. That speculation made our neighbour a rich man. 16. He told me he should on his own account speak to his father.

KEY TO EXERCISES IN LESSONS IN GERMAN.

EXERCISE 72 (Vol. I., page 324).

1. It is questionable whether we shall have fine weather to-morrow. 2. It is proper to keep holy the Sabbath. 3. It is proper to esteem older people. 4. One works more joyfully when one has the consciousness that one is doing something good. 5. It is not proper to decline the invitation. 6. The really prudent man will labour to adapt himself as much as possible to the times. 7. It affords great pleasure to further what is good. 8. It is proper that every foreigner should adopt the good, but not the evil customs of a people. 9. This man's wealth increases visibly. 10. It is not proper for children to be disobedient. 11. It is questionable whether this man has done his duty. 12. It sometimes happens that the considerations connected with a sportive occurrence are very serious. 13. It often happens that small circumstances occasion great events. 14. Who has met you this morning? 15. My friend the captain has met me. 16. Did anything disagreeable happen to him on his last journey? 17. Yes, a great misfortune befell him. 18. What has happened to you? 19. Nothing has happened to me. 20. This punishment serves him right.

EXERCISE 73 (Vol. I., page 324).

1. Es gehört sich, daß Kinder ihre Eltern achten. 2. Es schickt sich nicht für einen weisen Mann, der Menge zu folgen. 3. Die meisten jungen Leute wünschen groß in der Welt zu scheitern. 4. Sie sollten unter allen Umständen die Wahrheit sagen. 5. Es fragt sich, ob wir Ihre Einladung annehmen werden. 6. Es fragt sich, ob Sie Recht oder Unrecht haben. 7. Es trägt sich zuweilen zu, daß der beste Mensch irrt. 8. Die Regierung fördert Eiferer von ihren Unterthanen. 9. Die Bevölkerung Londons nimmt jedes Jahr ungeheuer zu. 10. Mein Bruder wüßte sich mehr den Wissenschaften, als dem Vergnügen. 11. Wissen Sie, wie weit Ihr Freund Ihnen gerathen hat? 12. Er hat Ihnen gerathen das zu thun, wovon er gestern sprach.

EXERCISE 74 (Vol. I., page 324).

1. What is that servant gone for? 2. She is getting water at the well, wood from the forest, and meat from the market. 3. Has she already gone for my trunk at the railway station? 4. Yes, she went for it directly after she got up. 5. We sent for a physician for the sick man. 6. He got me to copy the letter, and then to carry it to the post. 7. I neglect nothing to bring your son to a better course. 8. Let us not be deluded by this event. 9. One should suffer the dead to rest. 10. He kept me waiting, although I was in a hurry. 11. Why did you not let your little brother come? 12. Because he was all the afternoon at school. 13. Do you let your children learn French? 14. No, because I consider the English language more useful. 15. The major ordered his servant to show me the way to the village. 16. The gentleman whom you ask for had driven the captain into the country. 17. For whom do you send for the books? 18. I send for them for my youngest sister, in order to teach her Italian. 19. He had invited me to travel with him next week.

EXERCISE 75 (Vol. I., page 324).

1. Welchen von diesen Aergern werden Sie helen lassen? 2. Ich werde keinen von Beiden helen lassen. 3. Laß mich zufrieden, denn ich bin nicht wohl. 4. Nur seige Solraten lassen ihren Anführer im Stiche. 5. Warum tiefen Sie Ihre kleine Schwester nicht fennen? 6. Sie konnte nicht, denn sie war den ganzen Aergen in der Schule. 7. Er hat einen Zahnarzt helen lassen, um einen Zahn herauszuziehen. 8. Was lassen Sie Ihr Dienstmädchen helen? 9. Ich lasse sie Papier und Dinte helen. 10. Laßt uns menschlich hanteln. 11. Laßt uns doch nach der Schule gehen. 12. Laßt uns nicht den Beispielen der Götter folgen.

EXERCISE 76 (Vol. I., page 347).

1. What kind of weather is it to-day? 2. It is beautiful weather to-day, but it is somewhat colder than yesterday. 3. What opinion does he entertain concerning this thing? 4. His opinion of it is not the best. 5. My society is for him the most agreeable in the world. 6. What kind of fish are these? 7. They are sea-fish. 8. In what kind of work does he occupy himself? 9. He occupies himself partly in writing, partly in reading. 10. What a power music has over the mind of man! 11. What a great delight it is to see the world! 12. What a glorious aspect the firmament, with its innumerable stars, presents! 13. Every star in the heavens forms a world of its own. 14. The really virtuous man devotes every day of his life to laying aside his faults more and more. 15. Has not every one of your friends such a hat? 16. No, every one has a different one. 17. Such men are necessary, in order to save their native land. 18. Have you seen that blind man who possesses a delicacy of touch, which is astonishing? 19. Yes, I have seen him. 20. The giver of such a gift is to be praised. 21. The hardships of such a journey strengthen the body. 22. Such actions will call forth the admiration of posterity. 23. I have not had such agreeable hours for a long time. 24. Among the inhabitants there are many very opulent. 25. Have you not too lived to see many strange things? 26. O yes, I have already seen many remarkable things. 27. Many a brave soldier had to lose his life in the battle. 28. Has not this author written many good works? 29. Certainly, many of them are excellent. 30. Have both friends come to an understanding about this thing? 31. Yes, in some points they have agreed with one another. 32. Some English ships were sunk in this storm. 33. A few prudent men retired from the meeting. 34. All the inhabitants of the town fled at the enemy's approach. 35. Many persons pass their whole life in idleness. 36. Was that your brother who was the whole of yesterday in your society? 37. No, it was my nephew, who visits me once every year. 38. What a magnitude the earth has, and how much smaller, notwithstanding, is it than the sun! 39. What advantages has man over the beast? 40. What bird's feather is this? 41. If the scholar is industrious, he learns something.

EXERCISE 77 (Vol. I., page 347).

1. Mander Gelehrte ist misverstanten werden. 2. Das für Thorheiten begehrt der Mensch in seinem Leben? 3. Mit was für Gesellschaft hatten Sie Umgang? 4. Mandt fleißiger Kaufmann ist durch eine unvorsichtige Speculation zu Grunde gerichtet worden. 5. Manche Blume ist geferen, im Verborgenen zu blühen. 6. Jedes Blatt, jeder Zweig, und jeder Tropfen Wasser zeugen von unentlicher Weisheit und Macht. 7. Jeder muß Ardenschaft von sich selbst geben. 8. Die ganze Umgebung von Göttern ist romantisch. 9. Alle sind wohl zu Hause. 10. Die Unterhaltung mit solchen Menschen ist belehrend. 11. Ich habe nie von solch einem Unglücke gehört. 12. Es ist heute schönes Wetter, aber etwas kälter als gestern. 13. Ich habe schon manche Freute gehabt. 14. Ich wünsche einige Citronen zu haben. 15. Er kam etwas zu spät.

EXERCISE 78 (Vol. I., page 382).

1. He defended himself with an umbrella instead of a stick. 2. Instead of going with friends, he was always in the society of strangers. 3. They had a great chest in the room instead of a bed. 4. In Ger-

many they are very polite to foreigners. 5. The roots of the forest were his only nourishment. 6. Water, on this occasion, took the place of wine. 7. A scholar has taken the place of teacher. 8. They use pencils instead of pens. 9. Travelling gives me very much pleasure. 10. My children have learnt writing and reading of me. 11. Let us go; this long waiting is disagreeable to me. 12. They generally prefer sitting to standing. 13. He learnt to labour in his youth. 14. We learnt to write together. 15. I hate writing; on the contrary, I like painting so much the more. 16. He understands drawing better than painting. 17. We heard the bells pealing and the cannons thundering. 18. The howling of the storm, and the wild raging of the waves, heightened still further the courage of the brave captain and his crew, instead of depressing it. 19. Thinking God more benevolent than just, is equivalent to dishonouring him (Gellert). 20. This scholar's inexcusable behaviour vexed the teacher.

LESSONS IN CHEMISTRY.—XV.

SULPHUR AND ITS COMPOUNDS.

SULPHUR:—SYMBOL, S—ATOMIC WEIGHT, 32—DENSITY OF VAPOUR AT 1,000° CENT., 32.

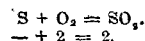
SULPHUR is a yellow solid which is found mixed with the soil in many volcanic districts. It also appears in combination with metals forming a large class of ores named sulphides; and moreover it takes some part in animal and vegetable economy, for it is found in albumen, hair, garlic, etc. The localities from which the greater part of the sulphur of commerce is procured are the valleys of Noto and Mazzaro, in Sicily. Here it is mixed with clays and breccia. Some sulphur is derived from metallic sulphides, particularly iron pyrites, FeS_2 , but this is liable to contain arsenic. The pyrites is heated in conical clay tubes, FeS remains behind, while the other atom of sulphur is liberated. The Sicilian sulphur undergoes partial purification at the mines by being submitted to a rough sublimation—that is, when heated to 490° Cent. the sulphur begins to boil, and to come off in vapour. This is passed into a chamber in which it is cooled, the vapour condensing into a fine yellow powder—flowers of sulphur. Sometimes the melted sulphur is run into wooden moulds, by which it is converted into cane sulphur, or brimstone.

Properties.—Sulphur is a brittle solid without taste or smell. When rubbed it emits a peculiar odour, and becomes negatively electrified. It is a very bad conductor of heat, and when a stick of brimstone is held in the hand in contact with the ear it crackles and frequently falls to pieces from the unequal expansion. It is quite insoluble in water, as may be easily seen by examining a piece of brimstone which has been for years in a vessel of water from which a lady's lap-dog drinks. The edges of the roll will be found as sharp as the day when it was first put into the water. Alcohol and ether have but a slight solvent action upon it, but the bisulphide of carbon, CS_2 , dissolves it freely. Sulphur exists in three modifications. The sulphur which appears in nature when crystallised, is in rhombic octahedra. This same shape is assumed when the bisulphide of carbon, which holds sulphur in solution, is evaporated. These latter crystals, however, are transparent. To procure the second modification, sulphur is melted, and when it is covered with a film on cooling, a hole is broken through the crust, and the sulphur which is still liquid is poured out; the under surface of the film and the sides of the crucible will be found covered with long needle-shaped transparent crystals belonging to the oblique prismatic form, and having a specific gravity of 1.98, whereas that of the native sulphur is 2.07. These crystals soon become opaque, and when touched crumble into powder, the particles of which are found to be crystals similar to those of native sulphur. Thus sulphur is "dimorphous," or capable of crystallising in two different systems. The third and more remarkable variety is produced by heat. At 115° sulphur begins to melt, forming a pale yellow mobile liquid. Upon raising the temperature its colour becomes darker, and at 250° it is an opaque mass, so viscid as to be poured from the vessel with difficulty; 20° higher it again resumes its fluid condition, and if it be poured into cold water when in this state, it becomes a soft and plastic mass of an amber-brown colour, and so tenacious that it can be drawn out into fine threads. It is in this condition that casts of medals, etc., are taken for electrotyping. After a lapse of some time it returns to its yellow colour and solid condition. In passing from one of these conditions to another, there is invariably a remarkable alteration in temperature.

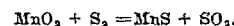
Oxides of Sulphur.—All the oxides of sulphur which are known possess acid properties:—

Hydric Sulphite or Sulphurous Acid, H_2SO_3 .
Hydric Sulphate or Sulphuric Acid, H_2SO_4 .
Hydric Hyposulphite or Hyposulphurous Acid, $\text{H}_2\text{S}_2\text{O}_3$.
Hydric Dithionate or Dithionous Acid, $\text{H}_2\text{S}_2\text{O}_4$.
Hydric Trithionate or Trithionous Acid, $\text{H}_2\text{S}_3\text{O}_6$.
Hydric Tetrathionate or Tetrathionous Acid, $\text{H}_2\text{S}_4\text{O}_{10}$.
Hydric Pentathionate or Pentathionous Acid, $\text{H}_2\text{S}_5\text{O}_{15}$.

Sulphurous Acid (symbol, SO_2 ; combining weight, 64; density, 32).—Sulphur burns in oxygen with a lilac-coloured flame, and the sole product of the combustion is the gas, SO_2 , which has a density double that of oxygen, for the gas occupies the same volume as the oxygen from which it is made, thus:—



The gas may be procured more easily by cautiously heating in a flask a mixture of 3 parts of sulphur and 4 of manganese dioxide; the reaction is thus expressed:—



A third process consists in heating sulphuric acid with copper or mercury in an ordinary flask—



The gas is well known for its suffocating odour. It cannot support combustion. Water at 0° Cent. dissolves 68.8 volumes of the gas, but this solution gradually absorbs oxygen from the air, and becomes converted into sulphuric acid. By causing the gas to traverse a tube surrounded by a mixture of salt and ice, or by submitting it to a pressure of 2 atmospheres, it liquefies into a colourless limpid fluid.

Fig. 46 shows the arrangement. The gas, to purify it, is sent through a "wash bottle," W, which contains concentrated sulphuric acid, by which the gas is dried. The liquefied sulphurous acid collects in the tube on the jar S, and is preserved

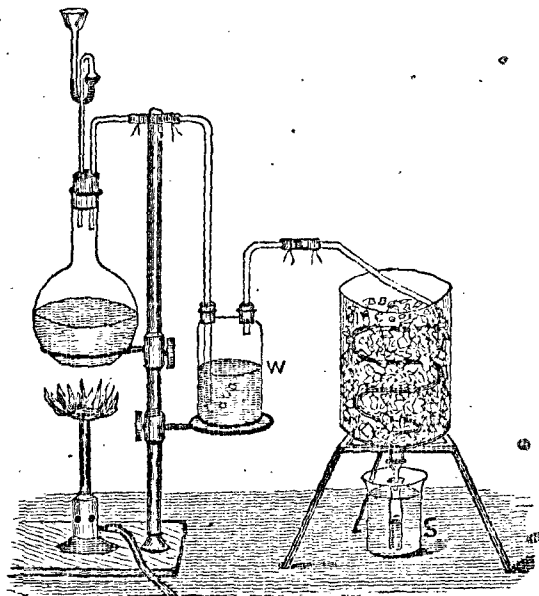


Fig. 46.

by hermetically sealing its neck. Of course, when exposed to the air, the liquid evaporates rapidly, and by this means a temperature of -60° Cent. may be obtained. This experiment may be easily shown by wrapping the bulb of an alcohol thermometer in muslin, and pouring some of the liquid upon it.

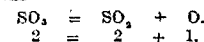
Sulphurous acid possesses great bleaching powers, and also antiseptic properties. If a red rose be held over the fumes of ignited sulphur its colour will be immediately changed. Chlorine cannot be used in bleaching silk, wool, and especially straw, as it

leaves them with a yellowish tinge. In these cases this gas is used. It seems simply to combine with the colouring matter, thus destroying it. The gas is sometimes used for checking vinous fermentation when it is proceeding too rapidly. This is done in the manufacture of cider, by burning sulphur over the vessel in which the fermentation is proceeding.

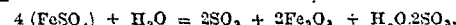
Sulphuric Trioxide (symbol, SO_3 ; combining weight, 80; density, 40).—This substance may be prepared by passing a mixture of sulphurous acid gas and oxygen through a tube containing spongy platinum heated to 180° Cent. In the pores of the platinum the sulphurous gas becomes oxidised into SO_3 , which passes out of the tube in white vapours, and condenses in a receiver into fine silky needles of sulphuric anhydride.

This substance possesses no acid properties until it combines with water, which it does with violence, forming sulphuric acid.

When the vapour of sulphuric trioxide is passed through a red-hot tube it is decomposed into 2 volumes of sulphic dioxide and 1 of oxygen, thus—



Nordhausen Sulphuric Acid ($\text{H}_2\text{O}_2\text{SO}_3$).—At Nordhausen, a town in Saxony, a fuming acid of the above name and formula was made by distilling green vitriol, which is iron sulphate, thus—



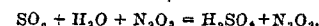
This acid, when heated, gives off sulphuric anhydride, and leaves British oil of vitriol behind, thus:—



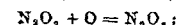
It is capable of dissolving sulphur, but its great use is to dissolve indigo, which property gives it its commercial value.

Sulphuric Acid, or Oil of Vitriol (H_2SO_4).—No chemical compound is of such use in the arts and manufactures as this; indeed, the commercial prosperity of a country may be very accurately measured by the quantity of sulphuric acid it consumes.

The mode of preparing the acid is to oxidise sulphurous acid gas, by means of nitric trioxide, thus—



Here it will be seen that the nitric trioxide gives one atom of its oxygen to the SO_2 , which thus becomes SO_3 ; this combines with an atom of water, forming H_2OSO_3 , which is usually written H_2SO_4 . The N_2O_3 is now N_2O_5 , nitric oxide; but in the presence of steam this gas is capable of combining with oxygen and returning to its former state, thus—



and it is again in a condition to oxidise another atom of SO_2 . Thus it appears that the nitric trioxide merely acts as a carrier of oxygen between the air and the sulphurous acid gas. Theoretically, a definite quantity of the trioxide can transform an indefinite quantity of the sulphurous into sulphuric acid. Practically, however, this is impossible, for reasons which will be sufficiently apparent. Fig. 47 shows the arrangement by which the manufacture of sulphuric acid is carried on. A chamber made of wood, sometimes 300 feet long and 15 broad by 15 high, is lined with sheet lead; water a few inches in depth covers the bottom; at one end there is a furnace in which sulphur is burning, and the flames of the sulphur heat a crucible containing sodium nitrate and sulphuric acid, which produce the fumes of nitric acid; at the other end is a boiler in which large quantities of steam are generated, and ejected into the chamber by means of pipes. There is an opening at r to admit air and produce a current through the chamber; sometimes, thoroughly to mix the various vapours, several partitions divide the chamber, having their openings alternately at the top and near the floor. The SO_3 , as soon as formed falls and combines with the water; this process generally proceeds until the acid reaches a density of 1.50. This is removed from the chamber and boiled in shallow leaden pans; when it reaches a density of 1.750 it corrodes the lead, and therefore a further condensation is carried on in platinum vessels. The oil of vitriol of commerce is generally impure, containing lead sulphate, as well as sulphates of any bases, lime, &c., which the water may contain, and if the acid has been made from iron pyrites, which is the case with all English acid, it is sure to contain arsenic. To decide if this be the case, develop hydrogen with the acid, ignite it, and the flame will

be bluish (Marsh's test). One of the oxides of nitrogen is generally present—this may be ascertained by the test given for nitric acid.

The presence of other salts may be determined by evapo-

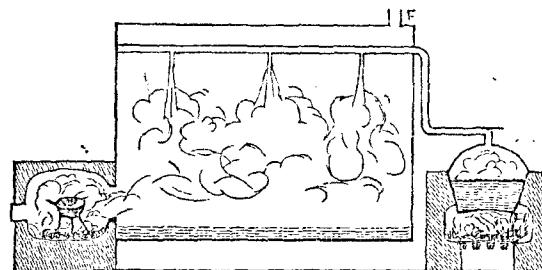
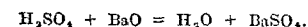


Fig. 47.

rating some of the acid in a platinum crucible; if any be present, they will remain.

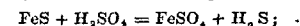
Properties.—This acid forms sulphates. It has a great affinity for water, of which it can take up fifteen times its weight if exposed long enough to the atmosphere. In combining with water, the temperature is greatly increased, and the volume of the mixed liquids is less than the sum of their volumes. The maximum condensation, 3 per cent., is reached when 3 volumes of acid are mixed with 2 of water. The best test for sulphuric acid is barytic water, or a chloride or nitrate of barium; the barium displaces any other base from its combination with the acid, and forms the insoluble barium sulphate, which falls in a white powder; thus—



The remaining five oxides of sulphur are not of sufficient interest to require a notice here.

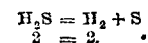
COMPOUNDS OF SULPHUR AND HYDROGEN.

Sulphuretted Hydrogen, or Hydric Sulphide (Symbol, H_2S ; combining weight, 34; density, 17).—This gas is always procured by treating some metallic sulphide with sulphuric acid. The sulphide of iron may be conveniently made by heating a rod of iron, such as that from which nails are made, to a strong red heat, then touching it with a stick of brimstone; the sulphur and the iron combine, forming ferric sulphide, FeS . In the same bottle in which hydrogen or carbonic acid gas was made, place this sulphide, and add diluted sulphuric acid—



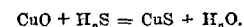
that is, iron sulphate (green vitriol) and sulphuretted hydrogen are the results of the reaction.

Properties.—It is this gas which imparts to rotten eggs their offensive odour. In the decomposition of the albumen, the sulphur which it contains unites with the hydrogen—another of its constituents—producing the gas. When passed through a red-hot tube, it is decomposed into sulphur and hydrogen; the latter having a volume equal to that of the undecomposed gas, as this equation would indicate:—



The gas is very poisonous, but when largely diluted with air, it acts as a very powerful narcotic.

It burns with a feebly luminous flame into water and sulphurous acid, a quantity of sulphur being deposited in the jar from incomplete combustion. Water, at ordinary temperatures, absorbs three volumes of the gas, and in this manner it may be kept for laboratory purposes; only oxygen must be excluded, for otherwise the hydrogen will be separated to form water, and the sulphur be deposited. This solution reddens litmus, and is therefore sometimes called hydro-sulphuric acid; whenever an oxide of a metal is presented to it, the metal becomes a sulphide, and the hydrogen of the gas with the oxygen forms water, thus:—



From the variety of colours which sulphides exhibit, and their behaviour under certain circumstances, this gas becomes a valuable test agent. By consulting the following table the tests

will be apparent. Sulphuretted hydrogen liquefies under pressure of 17 atmospheres.

METALS PRECIPITATED BY SULPHURETTED HYDROGEN.

In an acid solution.	Bismuth, the precipitate is Brown.
Arsenic, the precipitate is Yellow.	Cadmium " Yellow.
Antimony " Orange.	In a solution neutralised by ammonia.
Gold " Black Brown.	Iron the precipitate is Black.
Platinum " " "	Uranium " Black Brown.
Tin " Brown or Yellow.	Chromium " Green.
(The above precipitates dissolve in ammonia.)	Aluminium " Colourless.
Silver the precipitate is Black.	Cobalt " Black.
Mercury " " "	Manganese " Flesh Red.
Lead " " "	Nickel " Black.
Copper " " "	Zinc " White.

The Persulphide of Hydrogen (Symbol, HSr).—The exact amount of sulphur in this compound has not been determined; it is obtained by acting on calcium persulphide (CaS_2) with hydrochloric acid. It is a yellow oily liquid, and possesses bleaching properties.

LESSONS IN ARITHMETIC.—XXXVII.

DISCOUNT.

11. Discount is the abatement made from a debt in consideration of its being paid before it is due.

If A owes B a sum of money (£500 suppose) which is to be paid at the end of a given time (say six months), and instead of waiting until the six months have expired, discharges the debt now, it is evident that he ought not to pay the whole amount of the debt; for B could put out the £500 to interest, and then, at the expiration of the six months, he would be in possession not only of the £500, but also of the interest on £500 for that time.

In order that the transaction may be strictly equitable, it is plain that A ought to pay B such a sum as, put out to interest, would amount in six months to £500. The sum so paid is, for an evident reason, called the *present worth* of the debt; and the interest upon it which added to it makes up the amount of the debt, is the *true discount*.

The *true discount*, then, is the interest of the present worth for the time the debt has to run; or, what is the same thing, it is the difference between the amount of the debt and its present worth.

12. In mercantile transactions, where short periods of time are concerned, it is customary to deduct from the amount due the interest upon the amount, and not the interest upon the *present worth*. This mode of reckoning is manifestly inaccurate, and it is for this reason that we have used the expression *true discount*, meaning thereby to distinguish it from the ordinary discount of commerce.

The discount upon £105, due one year hence, at 5 per cent., is £5, because in 12 months £100 would amount to £105. The interest on £105, however, is £5 5s. at the same rate.

N.B.—Observe that the difference between the interest and the true discount is the interest upon the true discount for the given time.

13. To find the present worth of a given sum at a given rate per cent., due at the expiration of a given time.

This is exactly the same question as that explained in Art. 7 (Vol. II, page 403), viz., to find what principal will with its interest amount to the given sum in the given time at the given rate per cent.

EXAMPLE.—Find the present worth of £6812 17s. due 12 years 4 months hence, at $\frac{7}{4}$ per cent.

By the rule (see Art. 7) we have (since the interest of £100 at $\frac{7}{4}$ per cent. for 12 years is £7 $\frac{1}{2}$ × 12, or £90, i.e., £92 10s.

$$\frac{100}{92\frac{10}{12}} \times (£6812\ 17s.) = \text{as the required answer.}$$

$$£6812\ 17s. = £6812\ 85.$$

Therefore present worth is $\frac{100}{92\frac{10}{12}} \times £6812\ 85 = £6217\ 14s.$ which, when reduced, gives £2,539 2s. 10d.

The discount upon £6812 17s., being the difference between that sum and £2,539 2s. 10d., is £3273 14s. 1d.

14. To find the discount upon a given sum, due at the expiration of a given time, at a given rate per cent.

This may be done by finding the present worth, as in the last article, and then subtracting it from the amount.

* These are not precipitated as sulphides. The rest of the metals form sulphides soluble in water, and therefore do not give precipitates.

Or the discount may be found independently, as follows:—

Find the interest on £100 for the given time, at the given rate per cent. Multiply the given amount by this interest, and divide by the number formed by adding this interest to £100.

This will be seen at once, by stating it in the form of a Rule of Three question.

We will take a particular case.

EXAMPLE.—Find the discount upon £1031 17s., due six months hence, at 3 per cent.

In 6 months £100 would amount to £101 $\frac{1}{2}$ at 3 per cent.

Hence £1 $\frac{1}{2}$ is the discount on £101 $\frac{1}{2}$ due 6 months hence.

Therefore at the same rate per cent., and for the same time, we shall have—as £101 $\frac{1}{2}$: £1 $\frac{1}{2}$:: £1031 17s.

The result is £15 × $\frac{1031\frac{17}{2}}{101\frac{1}{2}} = \frac{309\frac{335}{2}}{203} = £15\ 5s.$ very nearly.

BILLS, ETC.

15. In commercial transactions, when one man engages to pay another a certain sum of money at the expiration of a certain time, a document is drawn up, according to an established form, upon a piece of paper, to which a government stamp of a certain value is affixed. The value of the stamp varies according to the amount of the debt, and tables of these stamps are given in most of our almanacks and pocket-books. Such a document is called a *Bill*.

A bill may be either what is called a *Promissory Note*, which contains a promise on the part of the undersigned to pay the money at the end of a certain time; or it may be a *Draft*, which contains a request or order to the debtor to pay. A draft is also sometimes called a *Bill of Exchange*.

We give the forms of both kinds:—

FORM OF A PROMISSORY NOTE.

£783 12s. 6d. sterling. London, Oct. 5, 1862.
Six months after date I promise to pay to Mr. Henry Jenkins, or Order, the sum of seven hundred and eighty-three pounds twelve shillings and sixpence sterling, value received.
WILLIAM JOHNSON.

FORM OF A DRAFT, BILL OF EXCHANGE, OR ACCEPTANCE.

£783 12s. 6d. sterling. London, Oct. 5, 1862.
Six months after date, pay to my Order seven hundred and eighty-three pounds twelve shillings and sixpence sterling, value received.
Mr. William Johnson, } HENRY JENKINS.
London. }
Accepted, payable at Messrs. Smith, Payne, Smith, and Co., }
London. } WILLIAM JOHNSON.

The above are two different forms by which William Johnson places himself under the obligation to pay £783 12s. 6d. to Henry Jenkins at the end of six months.

The draft is called an *Acceptance*, after William Johnson has what is called "accepted" the bill—that is, written across it "Accepted," etc., and signed his name. The acceptance (placed, in the above example, for convenience at the foot of the bill) is written across it by the Drawee. The person who makes out the bill (in this case Henry Jenkins) is called the *Drawer*. William Johnson, upon whom the bill is drawn, is called the *Drawee*, until he has accepted it, and then he is called the *Acceptor*. Sometimes the bill is made out to be paid to a particular person, who is called the *Payee*.

16. Such bills, before they become due, are passed about from hand to hand instead of money. The person in possession of the bill at any time is called the *Holder*, and when he pays it away to another person, he writes his name on the back, which is called *endorsing* the bill. The acceptor is always liable to the holder, who can also recover from the drawer and endorser. This transference of a bill from one hand to the other is called *negotiating* the bill.

It is evident from what we have said about discount that the value of such a bill continually increases, up to the time at which the debt is payable, the present worth being manifestly greater the shorter the time it has to run.

Suppose I take such a bill for £500 to a banker three months before it is due, and ask him to give me money for it; he will

LESSONS IN BOTANY.—XXVII.

SECTION LX.—JASMINACEÆ.

Characteristics: Calyx free; corolla hypogynous, regular, monopetalous, salver-shaped, five to eight partite; stamens two, inserted upon the tube of the corolla; ovary two celled, uni- or bi-ovulate; ovules collateral, ascendant; fruit a berry or capsule; seeds erect, dicotyledonous, exalbuminous.

The members of the family *Jasminaceæ* are usually trees or shrubs, often climbing, leaves ordinarily opposite, without stipules; flowers complete; calyx persistent; corolla imbricated in aestivation; anthers attached by their bases; albumen at first abundant, but towards maturity reduced to a very fine membrane; radicle inferior.

The *Jasminaceæ* are nearly allied to the *Oleaceæ*, from which they, however, differ in certain well-marked characteristics, such as the number of their sepals and petals, the aestivation of their corolla, the ascendant ovules, the endocarp never hard, the erect seeds, and albumen almost absorbed.

The principal region of this natural family is tropical Asia; a few species, however, are indigenous to the Mediterranean region. The greater number of the *Jasminaceæ* possess a volatile oil in the tissue of their corolla, not obtainable by distillation. The so-called oil of jasmine is the product of stratifying jasmine flowers with some fixed non-odorous oil, generally oil of ben. This oil, which is used by watchmakers because it does not freeze so readily as other oils, is expressed from the ben nut, the seed of the *Moringa pterygosperma*, or winged-seeded horse-radish tree, a tree which grows in Arabia and India, and the roots of which are used as we use horse-radish. The volatile oil of jasmine, to which allusion has just been made, is obtained chiefly from the flowers of the *Jasminum officinale*, or common white jasmine, or those of the *Jasminum grandiflorum*, or large-flowered jasmine. The last-named is a greenhouse evergreen climber, and not suitable for culture in the open air, like the common hardy deciduous climbers.

SECTION LXI.—VACCINIACEÆ AND ERICACEÆ.

Characteristics: Calyx free or adherent to the ovary; corolla inserted upon an annulus or disc, either hypogynous or epigynous, monopetalous or polypetalous, with four or five petals, regular; number of stamens equal to that of the lobes of the corolla, alternating with them, or double their number; anthers bilocular, usually opening by terminal pores; ovary one to five celled, with central placentæ; seeds inverse; embryo dicotyledonous, straight, in the axis of a fleshy albumen.

The plants which compose these two families are united into one, under the name *Ericaceæ*, by some authors. They are shrubs or evergreen trees; the leaves, ordinarily narrow, are articulated with the stem, and without stipules; flowers complete; calyx, four or five partite; corolla, four or five partite; the lobes varying as to depth, sometimes free, imbricated in aestivation; ovules pendent or reflexed.

Ericaceæ. Corolla hypogynous generally persistent; ovary free; fruit generally capsular.

Vacciniaceæ. Corolla epigynous, caducous; ovary inferior; fruit bacciform or drupaceous; leaves plane.

The *Ericaceæ* or heaths are dispersed over all the globe; they are especially abundant in the cold regions of the northern hemisphere, and at the Cape of Good Hope. Some species are gregarious, covering immense tracts in western and central Europe, where their presence indicates the soil to be unadapted to the culture of cereals. A great number of species belong to the Mediterranean region. The *Vacciniaceæ*, which takes its name from the *Vaccinium*, or whortleberry, grow for the most part on this side of the Tropic of Cancer, and in North America, chiefly inhabiting the temperate and cool regions of the northern hemisphere, especially the elevated mountains and hilly districts of America. Beyond the Tropic of Capricorn they altogether disappear. Most of the *Ericaceæ* contain bitter astringent principles, sometimes also a poisonous balsam. The berries of certain species are edible. The *Vacciniaceæ* are especially valuable for yielding a refreshing acidulated fruit. Their leaves are slightly astringent. The *Thibaudia macrophylla* produces berries which the inhabitants of Pasto, in Columbia, submit to fermentation, and produce

offer to "discount" it at so much (say 8) per cent. This means that he will give me £490 for it—that is, £500 less the interest for three months at 8 per cent. Now if the banker can borrow money at a less rate than 8 per cent. (say 5 per cent.) he can at once borrow £490 at 5 per cent. This would amount in three months only to £496 2s. 6d. He would thus be a gainer of £3 17s. 6d. by the transaction.

It is on this principle of discounting a bill at a higher rate of interest than that at which money can be borrowed, that bankers and bill-discounters make their profits.

17. In calculating the day upon which a bill becomes due, a certain number of days, which varies in different countries, called *Days of Grace*, are added to the time specified. In Great Britain, three days is the time allowed. Calendar months are always reckoned. Thus, a bill drawn on Feb. 15th at three months becomes actually due on May 18th. If a bill be drawn on the 29th, 30th, or 31st of a month, and the month in which it becomes due (not reckoning the days of grace) does not contain 29, 30, or 31 days, as the case may be, then the last day of the month is taken, and the three days of grace added.

Thus a bill drawn on Jan. 31st at three months would (without the days of grace) be due on April 30th, and therefore would be actually due on May 3rd.

EXERCISE 57.—EXAMPLES IN DISCOUNT, ETC.

Calculate the True Discount upon—

1. £45, due 1 year hence, at 5 per cent.
2. £325 10s., due 18 months hence, at $\frac{3}{4}$ per cent.
3. £1000 for 10 months, at 4 per cent.
4. What is the present worth of £450, payable in 6 months, at 6 per cent.?
5. What is the present worth of £840 16s. 8d., due 3 months hence, at $\frac{3}{4}$ per cent.?
6. Find the present worth of £519 4s., due 9 months hence, at $\frac{3}{4}$ per cent.
7. Find the difference between the True and the Commercial discount upon £3500, due 10 months hence, at 6 per cent.
8. Find the discount upon £430, due 18 months hence, at $\frac{3}{4}$ per cent.
9. Compare the cash and credit price of the same article; credit being given for one year, and simple interest at $\frac{4}{5}$ per cent. per annum being allowed. Find the cash price of articles, the credit price of which amounts to £114 1s. 7d.
10. The difference between the interest and the true discount for a certain sum for 2 years at $\frac{4}{5}$ per cent. is £2 11s. 8d.; find the sum.

[See N.B., Art. 12, in the preceding page.]

11. If the discount on £557 be £34 14s. 3d. at $\frac{4}{5}$ per cent., when is the sum due?

12. Two men owe equal debts to a third, both due at the end of 4 years; the one pays at once the equitable sum; the other leaves the amount of the debt in the bank for the benefit of the creditor, who thus receives sums in the ratio of 610,000 : 844,561. At what rate is the interest calculated?

In the following questions the *Mercantile Discount* is to be calculated.

Find the present worth of the following Bills:—

13. £235 8s. 6d., drawn 5th April, at 6 months; discounted 31st May, at 6 per cent.
14. £210, drawn 16th December, at 3 months; discounted 28th January, at $\frac{3}{4}$ per cent.
15. £1000, drawn 31st December, at 4 months; discounted 2nd February, at 5 per cent.
16. £1250 10s. 6d., drawn 29th November, at 3 months; discounted 21st December, at 6 per cent.
17. £850 17s. 6d., drawn 31st July, at 8 months; discounted 15th September, at 4 per cent.
18. £325, drawn 25th October, at 9 months; discounted 15th January, at $\frac{8}{10}$ per cent.
19. £755 5s. 9d., drawn 17th March, at 3 months; discounted 31st May, at 6 per cent.
20. £337 5s. 2d., drawn 29th August, at 3 months; discounted 27th October, at $\frac{3}{4}$ per cent.

KEY TO EXERCISES IN LESSON XXXVI.

- | | | |
|--|------------------|-------------------|
| EXERCISE 55. | | |
| 1. £26 2s. 8d. | 4. £2 0s. 5d. | 6. £21 2s. 2d. |
| 2. £33 0s. 9d. | 5. £19 17s. 1d. | 7. £111 7s. 5d. |
| 3. £43 19s. 7d. | | |
| EXERCISE 56. | | |
| 1. £55 3s. 4d. | 4. £1 15s. 6d. | 7. £51. |
| 2. £51 2s. 4d. | 5. £20 10s. 9d. | 8. £195 6s. 3d. |
| 3. £512s. 4d. to the nearest farthing. | 6. £129 17s. 2d. | 9. Lose £14s. 3d. |

a sort of wine. The flowers of *Thibaudia Quere* are used by the Peruvians in the composition of an aromatic tincture useful in toothache.

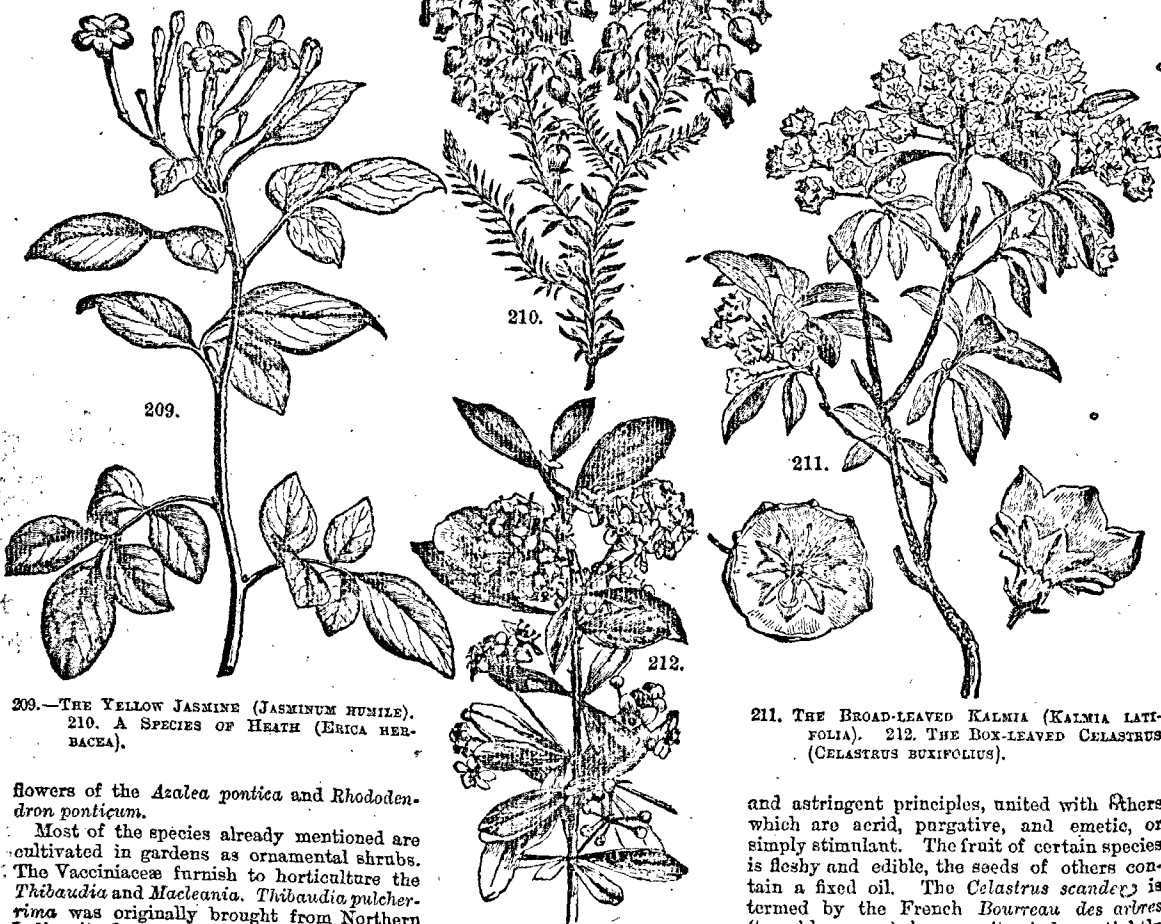
The rhododendrons, which belong to the family Ericaceae, are remarkable for their narcotic property. The yellow-flowered rhododendron (*Rhododendron chrysanthum*), a shrub growing in the Alps and Northern Asia, has bitter astringent leaves, employed occasionally in medicine.

Among the Vacciniaceae, the South American plant *Thibaudia microphylla*, a shrub which grows on the Andes in Peru, deserves to be mentioned. Its leaves contain a powerful narcotic, and if eaten by cattle they are fatal. *Kalmia latifolia*, if swallowed, causes a species of drunkenness and delirium, vomitings, convulsions, and frequently death. The intoxicating honey of the Euxine, so celebrated amongst the ancients from the date of the retreat of the ten thousand under the Greek historian Xenophon, derived its qualities from the

straight in the axis of a fleshy albumen; stem woody; leaves provided with caducous stipules, and ordinarily alternate.

The Celastraceae are usually shrubs, sometimes climbing. Their flowers are regular, axillary, disposed in cymes, small green, white, or purple in colour. The base of the calyx is surrounded with a fleshy disc, sometimes adherent to the ovary. The petals, enlarged towards the base, are inserted upon the border of the disc; imbricated in aestivation. The ovary is merged to a varying extent into the disc; ovules reflexed. Fruit, two to five celled, sometimes dehiscent, either drupaceous or samaroidal, or, finally, capsular with loculicidal dehiscence, or mode of splitting into the cells. The seeds are usually enveloped in a fleshy arillus. Radicle inferior.

The Celastraceae inhabit for the most part the sub-tropical regions of the southern hemisphere; towards either pole and the equator they become rare, and none are found in the two frigid zones. The greater number of Celastraceae contain bitter



209.—THE YELLOW JASMINE (*JASMINUM HUMILE*).
210. A SPECIES OF HEATH (*ERICA HERBACEA*).

flowers of the *Azalea pontica* and *Rhododendron ponticum*.

Most of the species already mentioned are cultivated in gardens as ornamental shrubs. The Vacciniaceae furnish to horticulture the *Thibaudia* and *Macleania*. *Thibaudia pulcherrima* was originally brought from Northern India; its flowers are disposed in umbels sessile upon the aged and leafless stems. The corolla of these flowers is tubular, campanulate, palish-red in colour, verging occasionally towards greenish-yellow, marked longitudinally and transversely with lines of deep red.

SECTION LXII.—CELASTRACEAE, OR SPINDLE-TREES.

Characteristics: Calyx free, of four or five sepals; corolla perigynous, of four to five petals; stamens four to five, alternate with the petals; ovary two to five celled, cells ordinarily containing one or two ovules; ovules ascending; fruit capsular or drupaceous; seeds generally provided with an arillus, or exterior coating fixed to them at the base only; embryo dicotyledonous,

and astringent principles, united with others which are acrid, purgative, and emetic, or simply stimulant. The fruit of certain species is fleshy and edible, the seeds of others contain a fixed oil. The *Celastrus scandens* is termed by the French *Bourreau des arbres* (trees' hangman), because it winds so tightly around the trunks of trees, that they are strangled. This species is indigenous to North America. Its bark is emetic. The *Celastrus venenatus*, a spring shrub growing at the Cape of Good Hope, is dangerous on account of the wounds it causes. The *Maytenus macrocarpus* is a Peruvian shrub, the leaves of which are acid. The *M. chilensis* is an efficacious remedy against the poison oak. The decoction of its leaves is employed as a wash for application to parts injured by the former plant. The kat or gat (*Catha edulis*) is cultivated along with coffee in Arabia, and is in great repute amongst the Arabs as a preventive of sleep. They moreover pretend that localities where this plant grows are always free from the plague.

MECHANICS.—II.

THE UNIT OF FORCE.—FORCES APPLIED TO A POINT.

HAVING in our first lesson explained the meaning of the word "force," and shown how a force is applied and measured, we shall next consider the simplest kind of mechanical problem, that of several applied to a single point. Before I proceed, however, it is advisable to fix clearly your notions of the "unit of force." I have already laid down the rule, that a force may be measured by the number of feet it would cause the unit ivory ball, equal in weight to a cubic inch of pure water, to move over in one second, when applied to it suddenly by a blow. If the ball move over seven feet, the number 7 should be written for the force; if over a furlong, the number is 660, the feet in a furlong. But suppose it moves over exactly one foot, then it is clear that the numeral 1 should be written; and that particular force is the "one" of forces. And the conclusion to which we thus are led is that—

THE UNIT OF FORCE is the force which would, if applied instantaneously to the unit of mass, make it move over one foot in one second.

But you can clearly see that the force which could produce no greater velocity than this in the ball—which, instead of being ivory, we may take to be a ball of frozen water, a cubic inch in volume—cannot be a very strong force. In fact, it is equal to a little less than eight grains of weight, that is, this unit of force could be balanced by that with which an eight-grain weight pulls downwards. How this is ascertained I cannot here explain to you, as you would require some little knowledge of dynamics to understand the proof. For the present, therefore, you must take my statement on credit.

But this unit is evidently too small for practical purposes. The strains in the mechanical powers, the lever, the wheel and axle, the pulley, etc., and in roofs and bridges, cannot be calculated in grains, on account of the large numbers we should have to operate on. A larger unit is therefore necessary, and the pound weight exactly answers the purpose. We can calculate and measure forces in pounds; or, if the figures in that case be too large, we can calculate them in hundred-weights, or even in tons. All that is necessary is to keep clearly in mind what your unit is in your calculation, and to know how to pass from one unit to another. If, in the same calculation, you were to use different units in different places—a pound for instance, in one, and a hundred-weight in another—without reducing the one to the other, the result could be nothing but confusion and error.

But how are you to pass from one unit to another? This is a nice point in practice, as we shall see in due time; but this much is clear, that, if your unit be a hundred-weight, you should multiply all the numbers which represent your forces by 112 (the number of pounds in a hundred-weight), and then these forces will be expressed in pounds. If they are already expressed in pounds, then divide by 112, and you will have them in hundreds and fractions of a hundred-weight. And so, from hundred-weights you can pass to tons by dividing by 20, and reverse the operation by multiplying by that number. Thus, we see that "ton," "hundred-weight," and "pound," are only so many different expressions for the same unit—namely, the pound—either singly or collectively, and that, therefore, for practical purposes, we may say that a pound weight is the "unit of force."

But we cannot leave this subject without determining the relation between this unit and the very small one of which I first made mention. I have asked you to take it on credit that the latter is nearly eight grains. The more correct value involves decimals, and is 7.85 grains nearly, that is, seven grains and eighty-five parts out of a hundred of one grain. Hence, since there are 7,000 grains in an avoirdupois pound, if we divide this number by 7.85, we shall have the number of these small units (which henceforth we shall call the dynamical unit), to which one pound weight is equal. The division gives 892 nearly for the quotient; and thus we learn how we may pass from dynamical units to pounds, or from pounds to these units. The result may be summed up in the following table:—

7.85 Grains make nearly one Dynamical Unit.
892 Dynamical Units make nearly one Pound.
112 Pounds make one Hundred-weight.
20 Hundreds make one Ton.

Forces applied to a Point.—When a single force is applied

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to any point of a body, if the latter be free, motion will ensue, and the question belongs to Dynamics. If it be not free, but fastened in any way to fixed objects, the force will be communicated through its substance to the points of support or connection, which will resist, and by resisting cause the body to sustain strain. For example, suppose a beam of wood is fixed at one point, round which, as on a pivot, it can turn in any direction, and that a force is applied to it at some other point. It is clear that this force will pull the beam round towards itself so far as it can go, that is, until the line of direction of the force passes through the fixed point. Then this point will resist, and equilibrium will be produced. The case thus becomes one of two forces—namely, that applied and the resistance produced; and we see thus that a single force can never in Statics be the subject of study, without involving the consideration of other forces which it calls into existence. A statical problem must be concerned about at least two forces.

If two forces be applied to a point in the same direction, we assume in Mechanics, as a self-evident truth, the result of experience, that their joint effect is the same as that which would be produced by a single force equal to their sum. If two men of unequal strength pull on a rope against another man stronger than either, who succeeds in balancing their united strength, we say, without hesitation, that his force is equal to the sum of those put forth by the two. When two forces thus act separately at a point, the single force to which their joint power is equal is called the "resultant" of these forces. We therefore say, if two forces act on a point in the same direction, their resultant is the sum of these forces. If three act on it, since two of them are equivalent to one equal to their sum, this one with the third must be equivalent to a single force equal to the sum of the three. And so on, as to more than three, we may lay it down as a general rule that—

The resultant of any number of forces acting on a point in the same direction, is a single force equal to the sum of the separate forces.

When two forces act in opposite directions on a point, for the same reason as in the former case, we assume that the resultant is the difference of the two. And this leads us to the most general case that can occur of such forces—namely, that in which any number of them are applied to a body along the same line, some in one direction and others in the opposite direction. To determine the resultant of all, it is evident that it is sufficient to take the separate resultants of the opposing sets, then take the difference of these resultants, and that this difference will be the required resultant of all, and its direction that of the greater of the two separate resultants. Hence the following rule:—

If any number of forces be applied to a body along the same line, their resultant is the difference between the sums of those which act in the opposite direction, and its direction is the same as that of the greater sum.

For example, if fifteen men pull on a rope against eleven, and brag them along a road, the resultant of the twenty-six forces applied to the rope along its length is the difference between the united powers of the fifteen and of the eleven, whatever be the particular strength of each man, and its direction is that in which the fifteen pull.

But suppose now that two forces only are employed, and that they are equal and in opposite directions; what will be the result? They will balance, or be in equilibrium. Now it is sometimes said that the body to which two such forces are applied at one of its points is in the same condition as if no force had been applied to it. This is not true, strictly. It is in the same condition so far as equilibrium is concerned, but not otherwise. It is not in the same condition as to pressure or strain. The rope, which at one moment is lying stretched on the ground, is not in the same condition it was in a few minutes before, when two strong men were pulling at opposite ends of it with balanced strength. In the latter case it is strained along its whole length—every thread on the stretch, ready to snap. Its condition is very different on the two occasions—different in every circumstance, except that of there being no motion. So, also, if two equal and opposite pressures are applied to a round ball, it will be an equilibrium, but the condition of its substance will be changed. Its particles will be pressed towards one another inwards; and, if it be made of soft or elastic material, its form will be altered by the flattening effect of the opposing forces.

And this is true, whatever be the magnitude of the ball. It may be as small as we please, even so small as an atom, or what is called a "material particle," and yet there will be this internal compression or straining. Thus we see that even the "material particle," acted on by two equal and opposite forces, cannot be said to be in the same condition before and after their application.

The case of equal and opposite forces presents some other points of interest, which may well occupy your attention in this lesson. Suppose, for example, two men pull against each other with equal strength at the opposite ends of a rope. What will be the strain on the rope? What will be its amount, considering that both are pulling? Most persons at first incline to say that it is strained by the united strength of both, or by double the strength of either man. Such is not the case; the strain is only equal to the strength of one of the men. What is the reason of this? A moment's reflection makes it evident. Suppose one man only to pull; the rope follows him, and there is no strain on it. But the instant the other seizes his end and pulls, strain begins, caused by his resistance. If he gives a strong pull, it is great; if a weak, it is slight. But, to put this in another way, suppose the first man leads, pulling with all his might, while the other, holding on with less strength, is dragged after. The rope is strained in this case also. By how much? By the less of the two forces. The stronger pull becomes divided into two parts, one putting both the rope and the second man in motion, and the other balancing the latter's pull. It is this second portion which strains the rope, and must be equal to the strength of the hinder man, while the other, which causes motion, is the difference of the two pulls or forces. Suppose, lastly, that the two pulls become equal, their difference becomes nothing, motion ceases, and the men come to a standstill. But the strain remains, as before, equal to the hinder force, which, being equal to that of the leading man, we can say it is equal to either of the forces.

Let us next suppose that for one of the men an iron ring, fastened on a wall, is substituted, to which one end of the rope is attached. So long as the rope hangs loosely from the ring there is no strain on it. Let the other man now pull at the far end, the rope at once is strained, evidently not by the wall, but by the man's pull. The wall puts forth no more effort to strain it than it did before; but simply resists the force communicated to it through the rope. It is, in fact, a case of a force applied to the wall through the rope, every point of which may be considered a point of its application.

Again, take two equal weights attached to the ends of a cord which passes over a pulley. The strain on the cord which hangs down at either side is evidently equal to the weight on that side; and, since the weights are equal, the strains on both sides, and therefore all through the cord, are equal to that weight.

In all these cases the forces were of the nature of a pull, causing a stretching strain. But the conclusions hold equally good of pushing forces. If two such, equal to each other, be applied to a ball at opposite sides in opposite directions, the compressing strain within the ball will be equal to only one of the forces. Or if the ball be pushed against a wall by only one of them, though the wall resists, the strain will still be the same—equal to the single force. The resistance counts for nothing. Also, when the two forces are unequal, and motion ensues, there is a compressing strain equal to the smaller force, while the motion produced is due to the difference of the forces. When a man ascends a ladder with a hod of mortar, there are two such compressing forces acting on his shoulder at the spot on which the hod rests—namely, his own muscular power pushing his shoulder upwards, and the weight of the hod and mortar pushing it down. His ascent is effected by the difference of these forces, the muscular being the greater; while the compressing strain is evidently the weight of the loaded hod. These examples will make clear to you the principle I have been explaining; and you will find no difficulty in multiplying them by thinking of others yourselves.

We now pass to the case of three forces, whose directions are all different, applied to a point, and producing equilibrium. Now it is evident, first of all, that the three must pull or push in the same plane or flat, such as, for instance, the flat surface of a table; for if two of them pulled along that surface, while the third pulled in a slanting direction upwards, this latter force

should lift the body off the table. Try the experiment with three strings attached to a ring which lies flat on a table, two of which are pulled horizontally along the table, and the third in any direction upwards. The ring will be lifted, and soon the three strings will come into one plane. I am not here taking into account the weight of the ring and strings, which are a fourth force applied to the body. For the sake of simplification, to enable you to understand the principle, I suppose these to be so small in comparison to the others as to count for nothing.

Secondly, when three forces applied to a point are in equilibrium, the resultant of any two of them is equal and opposite to the third force. This is also evident; for if it were not, the resultant of the two and the third force, to which the three are equivalent, would not be two forces equal, and opposite to each other, and therefore could not make equilibrium. In the case of the ring on the table, to which the three strings are attached, if the direction of the effect of the pulls on two of the strings were not opposite to that of the third pull, the three would make the ring move to the side of the table, towards which these two directions incline. And, furthermore, even if the directions were opposite, the ring would move, if the effect of the two, or their resultant, were not equal to the third force. These two principles may be definitely stated as follows:—

1. When three forces applied to a point are in equilibrium, they are in the same plane.
2. The resultant of any two of three forces in equilibrium at a point is equal and opposite to the third force.

LESSONS IN GREEK.—XV.

EXERCISES FROM THE BOOK OF PROVERBS.

1. Τίς σοφός ευφραίνει πατέρα, υἱὸς δὲ ἀφρων λυπή τῇ μητρὶ.
2. Πενία ἀνδρα ταπεινῶν, χεῖρες δὲ ἀνδρὶν πλουτίζουσιν.
3. Εὐλογία Κυρίου ἐπὶ κεφαλῇ δικαίου.
4. Μνήμη δικαίων μετ' ἐγκωμίων (understand ἐστὶ), ὄνομα δὲ ἀσεβῶνς σβεννύται.
5. Μῖσος ἐγείρει νεκρός.
6. Ὅς ἐκ χειλέων προσφέρει σοφίαν, βαβδῶ τυπτεῖ ἀνδρα ἀκαρδίον.
7. Ἀντὶ διγλωσσῶς ἀποκαλύπτει βουλὰς ἐν συνεδρίῳ, πιστὸς δὲ πρὸς κρυπτεῖς πράγματα.
8. Τὴν σπουδαία στεφανὸς τῷ ἀνδρὶ.
9. Λόγον ἀδικῶν μῖσει δικαίος, ἀσεβὴς δὲ αἰσχύνεται.
10. Σιδηρὸς σιδηρὸν ὀξύνει, ἀντὶ δὲ πρὸς ὅντι προσώπων ἑταίρου.
11. Ὅσπερ δροσὸς ἐν ἀμῆτι, καὶ ὥσπερ ὕετος ἐν βερεῖ, οὕτως οὐκ ἐστὶν ἀφρονὶ τιμὴ.
12. Ἀκαθάριστα φρονταὶ ἐν χερὶ μεθύσμου, δουλεῖα δὲ ἐν χερὶ τῶν ἀφρων.
13. Σοφία καὶ ἐννοία ἀγαθὴ ἐν πύλαις σοφῶν (understand εἰσὶν) σοφοὶ οὐκ ἐκκλινουσὶν ἐκ στόματος Κυρίου.
14. Αποθήσκει ἀφρων ἐν ἀμαρτίαις.
15. Μὴ χαίρει ἐπὶ κακοποιῶσι, μὴδὲ ἡλὼν ἀμαρτωλῶν.
16. Φόβον τὸν Θεόν, υἱὲ, καὶ βασιλεῖα.
17. Λογὸς σοφῶν παραβάλλει σὺν οὓς, καὶ ἀκούει ἔμῃον λόγον.
18. Ἐλεημοσύνη καὶ ἀληθεῖα φυλάκη βασιλείᾳ.
19. Κοσμὸς νεανίας σοφία, δοῦλα δὲ πρὸς βυτηρίων πολίων.
20. Πᾶς ἀνὴρ φαίνεται ἑαυτῷ δικαίος, κατευθύνει δὲ καρδίας Κυρίως.
21. Ἀκαλαστον οἶνος, καὶ ὕβριστικὸν μεθῆ, πᾶς δὲ ἀφρων τοιούτοις συμπελεκτά.

VOCABULARY TO THE PASSAGES FROM THE PROVERBS.

1. Ευφραίνω, I rejoice (transitively); λυπή, -ης, ἡ, grief.
2. Πενία, -ας, ἡ, poverty; ταπεινῶ, I lower, degrade; ἀνδρείος, -α, -ον, manly, excellent; πλουτίζω, I make rich (from what noun is the verb derived?).
3. Εὐλογία, -ας, ἡ, a blessing (what are the components of the noun?); Κύριος, -ου, ὁ, lord, master, the Lord—that is, the Almighty, in the Old Testament; δικαίων, for τῶν δικαίων. The article is often omitted in the Greek version of the Hebrew Scriptures. This version is called the Septuagint, sometimes "the Seventy," because said to have been made by that number of learned Jews in Alexandria in Egypt; the translation was completed in the second century before Christ.
4. Μνήμη, -ης, ἡ, memory, the memory; ἐγκώμιον, -ου, τό, praise, eulogy, our word encomium; ἀσεβής, -οῦς, impious, compare σεβῶμαι, I worship; σβεννύμι, I extinguish; σβεννύται, is extinguished, that is, destroyed.
5. Μῖσος, -οῦς, τό, hatred, connected with μίσω, I hate; νεκρός, -οῦς, τό, strife; here is exemplified the remark that in Attic Greek this proposition would be τὸ μῖσος ἐγείρει τὸν νεκρόν.
6. Ὅς, the relative pronoun he who; χεῖλος, -οῦς, τό, a lip; βαβδῶ, -ου, ἡ, a stick, staff; ἀκαρδῖος, -ον (from α, not, and καρδία, the heart), heartless, senseless.
7. Διγλωσσός (from δις, twice, and γλῶττα, -ης, ἡ, a tongue),

double tongued; ἀποκαλύπτω (ἀπο, from, and καλύπτω, I hide), I conceal; συνεδρίον, -ου, τό, an assembly, hence our word sanhedrim, the name of the Jewish Parliament; πρὸς, -ης, ἡ, a breathing, breath; πιστός here would in classical Greek be ὁ πιστός.

8. Στέφανος, -ου, ὁ, a crown, hence our proper name, Stephen.

9. Αἰσχυνομαι, I am ashamed of, from αἰσχος, -οῦς, hatfulness, shame.

10. Σιδηρός, -ου, ὁ, iron; ὀξύνω, I sharpen; in παραδίδωμι, the preposition παρα strengthens the force of the verb; ἑταῖρος, -ου, ὁ, a companion, friend.

11. Ἀμῆτος (from αἶμα, I bind in bundles), harvest time; ἑτερος (from εἶναι, Lat. placere, to rain), rain; θερος, -ους, τό, summer.

12. Ἀκαθά, -ης, ἡ, a thorn; φῶ, I produce (Lat. fui, I was), φουά, I am produced, I am born, I spring up; μεθύσμος (from μεθῶ, wine, strong drink), drunken; ἀφρων, -ονος (from α, and φρην), senseless, fools.

13. Ἐννοία, -ας, ἡ, sense (from ἐν, in, and νους, the mind); πύλη, -ης, ἡ, a gate; ἐκκλινῶ (ἐκ, from, and κλινῶ, I bend), I turn away.

14. Αποθήσκω (ἀπο, from, and θνήσκω, I die), I die; ἀμαρτία, -ας, ἡ, sin; consult ἀμαρτανῶ, already explained.

15. Χαίρω, I rejoice; κακοποιός, -ου, ὁ (κακός, evil, and ποίω, I do), an evil-doer; ἡλὼν, I desire, envy; ἀμαρτωλός (ἀμαρτανῶ), a sinner.

16. Φοβέομαι, I fear, reverence.

17. Παραβάλλω (παρα, near, βάλλω, I throw), I apply to; σὺ, thy, here the personal pronoun is used for the article, ordinary Greek giving τὸ οὗ; ἐμός, my.

18. Ἐλεημοσύνη (from ἐλεός, pity), mercy; hence our word eleemosynary, which, through the old English almesse, is contracted into alms.

19. Πρεσβύτερ (our presbyter, whence our priest), an old man; πολίος, -α, -ον, bald, grey; πολία, grey hairs (understand τριχες, hair).

20. Φαίνομαι, I appear; ἑαυτῷ, to himself; κατευθύνω, I direct, guide.

21. Ἀκαλαστός, -ον (α, not, and κολάζω, I punish, restrict), unrestrainable, riotous; ὑβριστικός, -ον, insulting; μεθῆ, -ης, ἡ, drunkenness; τοιούτος, such; τοιούτοις, such things; συμπελεκῶ (συν, with, and πελεκῶ, I fold), I bind together; συμπελεκτά, is entangled in, is chained to.

EXERCISES FROM THE NEW TESTAMENT.

1. Μακάριος (understand ἐστίν) ἁνὴρ ὃς ὑπομένει πειρασμόν.
2. Ἐκάστος πειράζεται ὑπο τῆς ἰδίας ἐπιθυμίας.
3. Ἡ ἐπιθυμία τυκτεῖ ἀμαρτίαν, ἡ δὲ ἀμαρτία ἀποκτείνει θάνατον.
4. Πᾶσα δοῦσις ἀγαθὴ καὶ πᾶν ἔργον ἀγαθὸν ἀνθεν ἐστὶ καταβαρὺν ἀπὸ τοῦ Πατρὸς τῶν φῶτων.
5. Ὅργη ἀνδρὸς δικαιοσύνης Θεοῦ οὐ κατεργάζεται.
6. Γίνεσθε ποιηταὶ λόγου, καὶ μὴ μόνον ἀκοῦσαι.
7. Ὁρῶσθε καθαρά καὶ ἀμιαντὸς παρα τῷ Θεῷ καὶ Πατρὶ αὐτῆστιν, ἐπισκεπτεσθῶν ὀρφανούς καὶ χήρας ἐν τῇ θλίψει αὐτῶν, ἀσπίλον ἑαυτὸν τηρεῖν ἀπὸ τοῦ κόσμου.
8. Ἡ ἀνθεν σοφία πρῶτον μὲν ἄγνη ἐστίν, ἐπειτα εἰρηνικὴ, ἐπεικὴς, εὐπειθὴς, μεστή ἐλεος καὶ καρπῶν ἀγαθῶν, ἀδιακρίτος, ἀνυποκρίτος, καρπὸς δὲ δικαιοσύνης ἐν εἰρήνῃ σπειρεται τοῖς ποιοῦσιν εἰρήνην.
9. Ποθεν πολέμοι καὶ πόθεν μάχαι ἐν ὑμῖν; οὐκ ἐντεθεν, ἐκ τῶν ἡδονῶν ὑμῶν, τῶν στρατευομένων ἐν τοῖς μελεσὶν ὑμῶν.
10. Μοῖχοι καὶ μοιχαλίδες, οὐκ οἰδεῖτε ὅτι ἡ φιλία τοῦ κόσμου ἐχθρὰ τοῦ Θεοῦ ἐστίν;
11. Ὁ Θεὸς ὑπερβαίνει ἀντιτασσεται, ταπεινῶς δὲ δίδωσι χάριν.
12. Εἰς ἐστὶν ὁ νομοθετὴς καὶ κριτὴς, ὁ δὲ δυναμένος σωσαὶ καὶ ἀπολεσαὶ.—The General Epistle of St. James.

VOCABULARY TO THE EXTRACTS FROM THE NEW TESTAMENT.

1. Μακάριος, -α, -ον, happy, blessed; ὑπομένω (ὑπο, under, and μένω, I remain), I endure; πειρασμός, -ου, ὁ (πειράζω, I try, tempt), trial.
2. Ἐκάστος, -η, -ον, each, every; ἰδίας, -α, -ον, one's own.
3. Αποκτείνω (ἀπο, from, and κτείνω, I conceive, am pregnant), I bear, I bring forth; θάνατος, -ου, ὁ, death.
4. Δοῦσις, -εως, ἡ, a giving; ἔργον, -ατος, τό, a gift; τελείος, -α, -ον, perfect; ἀνθεν (ἀνα, from above, the termination θεν gives the idea of from, compare in Sentence 9, ποθεν ἐντεθεν; καταβαρύνω (κατα, down, and βαρύνω, I come down, ἐστὶ κατ, literally, is coming down, is constantly coming down—a beautiful description of the constancy of the heavenly Father's goodness; φῶς, φῶτος, τό, light).
5. Ὅργη, -ης, ἡ (the root of ορεγομαι), desire, effort, a strong

emotion, anger; δικαιοσύνη, -ης, ἡ, justice, just designs; κατεργάζομαι (κατα, down, thoroughly, and ἐργον, a work), I accomplish.

6. Γίνομαι (the old form of γίγνομαι, compare γένος, a race, a kind), I become; ποιητής, -ου, ὁ, a doer, a maker, hence our poet, the great maker, that is, inventor; ἀκοῦσας, -ου, ὁ, a hearer.

7. Ὁρῶσθε, -ας, ἡ, service, God's service, religion; καθαρός, -α, -ον, pure; ἀμιαντός (μιαίνω, I spot), unspotted; καί, even, that is, ὅστος, αὕτη, τούτο, this; ἐπισκεπτομαι (ἐπι, over, and σκεπτομαι, I survey) I go to see, or visit; from the same root is our bishop, that is, an overlooker, a superintendent; ὀρφανός, -ου, ὁ, our word orphan; χήρα, -ας, ἡ, a widow; θλίψις, -εως, ἡ, affliction; αὐτῶν, of them, their; ἀσπίλος, -ον, unstained (σπίλος, a stain), τηρεῖν, I keep, preserve.

8. Ἄγνος, -η, -ον, chaste, holy; πρῶτον, in the first place, ἐπειτα, then, in the second place; εἰρηνικός (εἰρήνη, peace), peaceful; ἐπεικὴς, mild; εὐπειθὴς (πειθῶ, I persuade), easy to be entreated; μεστός, -η, -ον, full; ἀδιακρίτος (α, not, δια, through, κρίνω, I distinguish), without partiality; ἀνυποκρίτος (α, not, the υ is interposed between the two vowels for the sake of euphony; ὑπο, under, and κρύνω, hence our word hypocrite), without hypocrisy; σπειρώ, I sow; τοῖς ποιοῦσιν, for those doing, that is, those who do or pursue.

9. Ποθεν, whence; ἐντεθεν, thence; ὕμνων, of you, your; στρατευομαι, I war; τὸν στρατὸν ἐνομένω, which make war; μέλος, -ους, τό, a limb, member; ὑμῖν, in you.

10. Μοῖχος, -ου, ὁ, an adulterer; μοιχαλῖς, -ίδος, ἡ, an adulteress; οὐκ οἰδετε, know ye not? ἐχθρὰ, -ας, ἡ, hatred.

11. Ὑπερβαίνει (ὑπερ, above, high, too much, and βαίνει, I show), haughty; ἀντιτασσεται (ἀντι, against, and τασσῶ, I set), I array myself in opposition to; ταπεινός, -η, -ον, low, lowly, humble; δίδωσι, he gives.

12. Νομοθετὴς (νομός, a law, and τίθημι, I place), a lawgiver; δυνατός, I am able; ὁ δυναμὸς ἐνός, who is able; σωζῶ, I save; ἀπολλύμι, I destroy; σωσαὶ and ἀπολεσαὶ are infinitives governed by ὁ δυναμένος.

KEY TO EXERCISES FROM THE BOOK OF PROVERBS.

1. A wise son maketh a glad father, but a foolish son is a grief to his mother.
2. Poverty bringeth a man low, but the hands of the diligent make rich.
3. The blessing of the Lord is on the head of the just.
4. The memory of the just is preserved with praise, but the name of the impious is extinguished.
5. Hatred begetteth strife.
6. He who applyeth the wisdom of his lips striketh the senseless man (as) with a staff.
7. The double-tongued man concealeth his thoughts in the assembly, but the faithful man concealeth only his deeds by speech.
8. A virtuous woman is a crown to her husband.
9. The just man hateth an unjust speech, and even the ungodly man is ashamed of it.
10. As iron sharpeneth iron, so a man sharpeneth the face of his friend.
11. As dew in harvest time, and as rain in summer, so is honour to one who is not indiscreet.
12. Thorns grow up in the hand of a drunkard, and slavery in the hand of the foolish.
13. Wisdom and good sense are in the gates (i.e., dwellings) of the wise, and the wise turn not away from the mouth of the Lord.
14. The fool perishes in his follies.
15. Rejoice not with them that do evil, nor emulate sinners.
16. Fear God, my son, and the king.
17. Turn thine ear to the words of the wise, and hear my word.
18. Mercy and truth are a king's defence.
19. Wisdom is an ornament to young men, and hoary hairs are the glory of old men.
20. Every man appears to himself just, but the Lord directeth the heart.
21. Wine is a thing that is ungovernable; drunkenness is that which begetteth insolence, and every foolish person is entangled in such things.

KEY TO EXERCISES FROM THE NEW TESTAMENT.

1. Blessed is the man who endureth temptation.
2. Each man is tempted by his own lust.
3. Lust produceth sin, and sin bringeth forth death.
4. Every good gift and every perfect gift cometh down from above, the Father of lights.
5. The anger of man worketh not the righteousness of God.
6. Become doers of the word, and not hearers only.
7. Pure and undefiled religion before God and the Father is this, to visit the orphans and widows in their affliction, and to keep himself unstained from the world.
8. The wisdom that is from above is first pure, then peaceful, just, easily persuaded, full of pity and good fruits, without partiality, without hypocrisy, and the fruit of righteousness is sown in peace in those that pursue peace.
9. Whence are wars and whence are fightings among you, are they not thence even from your pleasures, which war in your limbs?
10. Ye adulterers and adulteresses, know ye not that the friendship of the world is enmity against God?
11. God sets himself against the proud, and giveth grace to the lowly.
12. There is one lawgiver and judge, who is able to save and destroy.

* * * Compare the above with the translation of the Bible now in use

RECREATIVE NATURAL HISTORY.

THE CAT FAMILY.

THE domestic cat is generally a family pet, but not always deservedly so, for it occasionally plays the thief if there be any toothsome morsel within sight or smell, and no one there to watch it. But notwithstanding this frailty, it is generally so quiet and unobtrusive, remaining on the hearth for hours without once giving any sign of its presence, and, moreover, so useful in keeping down the mice, that few householders like to be without one. Far below the dog in vigour and intelligence, it is nevertheless an animal of extreme interest, for it seems still to have most of the wild instincts of the tribe to which it belongs.

Just watch Puss while trying to catch that unwary fly which has alighted on the floor. With eyes keenly fixed on its intended prey, and nose to the ground, it stealthily advances to within springing distance, then at one bound it has brought a paw down on the insect, and in the next instant it is eating it with apparent relish. Its game generally is of larger kind, and not so easily caught. A sparrow, tempted by the crumbs thrown out of doors, has ventured to come for its humble meal. While it is busy pecking at these fragments, Puss, who has seen the bird arrive, is revolving in its feline mind how it may encompass the sparrow's destruction. It advances quietly and very cautiously, under cover of every object that happens to be in the way of it and the bird, and when it has reached its last vantage ground, makes a spring, which is the first intimation the bird has received of its presence. For a moment the sparrow is paralysed, then it shrieks out in terror, while Puss cruelly carries it away. This game the cat plays at with greater freedom if it can have access to a neighbouring garden or orchard. There it will move noiselessly about, ever on the alert for any game that may turn up. Did you ever see it capture a mouse? How it has curled its tail preparatory to the spring! And what a savage growl it has uttered when it has got the stupefied creature within its grasp! These are the qualities the cat has in common with the tiger of Indian jungles and the lion of African deserts, and we find it well fitted for the work. The cat has very acute hearing, especially for those shrill sounds which mice emit, and any approach to such a sound will instantly take its attention, which is shown by its turning an ear towards the direction whence it supposes the sound to have come. Ages of domesticity have not caused it to lose control over its ear muscles. It is mentioned by Darwin that cats which are entirely white and have blue eyes are generally deaf, but he further adds that it has been stated by Mr. Tait that this peculiarity is confined to the males. The domestic cat is easy and graceful in its movements. Pettigrew has pointed out as a curious fact in animal locomotion that if one observes a cat from above when walking, a continuous wave of movement is observed travelling along the spine from before backwards, a movement which characterises the walk of other quadrupeds, and which results from the diagonal order in which they lay down their feet when walking. He points out that this movement closely resembles the crawling of the serpent and the swimming of the eel. The cat's sight is good, and appears to be adapted for seeing with a minimum amount of light in its nocturnal prowls. Its feet are specially adapted both for silently treading along, and also for seizing and tearing its prey. Observe it when stretching itself against a table-leg or other upright piece of wood; its claws are then extended, and frequently leave their marks, to the no small annoyance of the good housewife. Ordinarily the claws are drawn in, so that if you feel at the under-surface of the foot it appears quite soft, the doubled-up claw on each toe having a soft cushion under it; this it is which makes its tread so noiseless. The claw is doubled up without any exertion on the part of the cat, so that when it makes its spring on its prey a special muscle is called into play which causes it to be extended.

These are characteristics of the whole family of cats, which includes the lion, tiger, panther, leopard, ounce, serval, jaguar, puma, and ocelot, &c., for they have all the noiseless footfall, and the peculiar claws which are retracted when running, walking, or jumping, but protracted when springing on their prey. They walk on their toes, and are therefore said to be *digitigrade*, as opposed to *plantigrade* (from Latin, *gradior*, I walk, and *planta*, the sole of the foot), a name given to those carnivores which

apply the sole of the foot to the ground like the bear. Their heads are round; jaws short and powerful, armed with teeth, and their tongues like files, rough, with horny papillae directed backwards, which serve to scrape off the last remains of flesh from any bone they may be licking. Their long whiskers are very sensitive organs of touch, and they have a keen sense of smell. The family is a carnivorous or flesh-eating one, and along with some other families of animals, forms the great order of carnivora.

The cats—i.e., lion, tiger, panther, &c.—have, in common with other carnivora, short intestines, which results from their flesh-eating habits: a wonderful adaptation of the alimentary apparatus to the kind of food habitually eaten by these animals. The shortness of the intestinal canal appears all the more wonderful when we contrast its length with that of the intestines possessed by herbivorous animals like the sheep and cow; thus in the cat tribe the intestinal tube is not more than three times the length of the whole body, whereas in many herbivorous animals it is thirty times as long as the body.

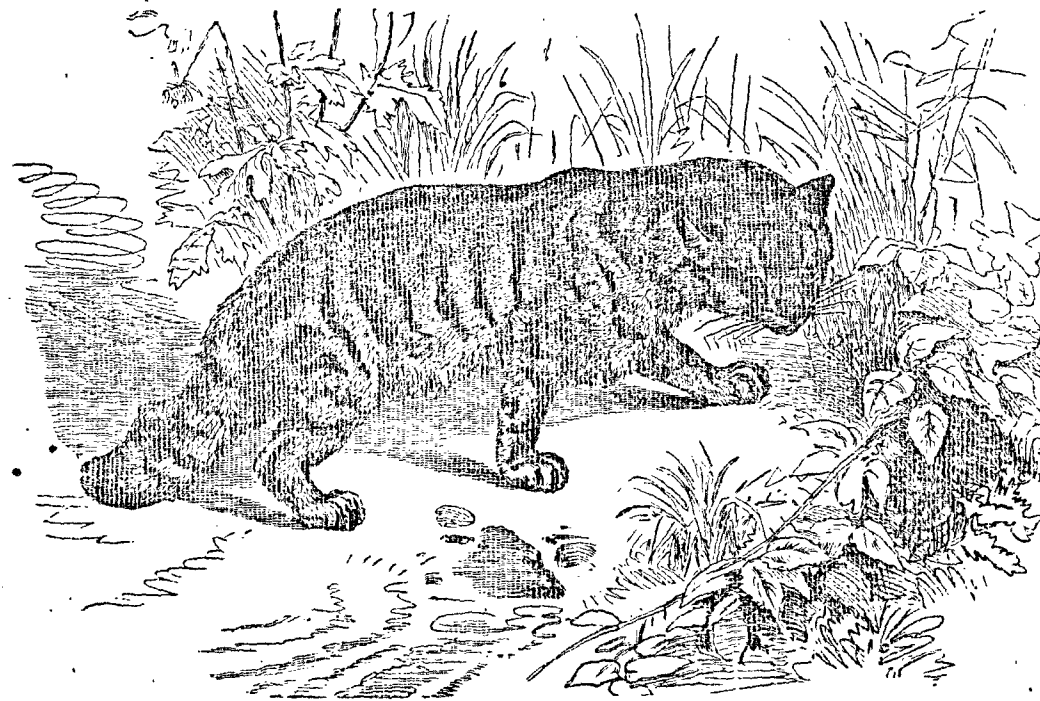
We may now proceed to give a short account of some of the more important members of the cat, or Felidae family.

The lion has for long been regarded as the "king of beasts," as the symbol of courage and strength, and it is perhaps on this account that more tales have been told of its daring and prowess than of any other animal, if we except the dog. How far these narratives may have been true it is at times difficult to decide, even if one were disposed to disprove and take away the charm of stories of the Androcles class. It appears under the most trying circumstances to preserve a noble and dignified bearing, as if conscious of the enormous strength it can put forth when required, a strength so great that it has been known to carry a heifer in its mouth as easily as a cat would a rat, and has even leapt over a fence or ditch with its burden. Some of its traits are very well shown in the accounts that have been given of it by travellers of undoubted veracity. Livingstone's experience was both startling and interesting. He had just fixed on the valley of Mabotea in South Africa as a suitable place for establishing a mission station, when he was informed that several lions had been destroying the cattle of the natives. Livingstone at once proceeded to help the people to exterminate the animals. They were traced to a small wooded hill, which the natives surrounded, and, with the intention of driving the lions into a favourable position for firing at, they beat through the underwood. Livingstone had fired at one of the animals, and was just reloading, when he was startled by the warning cry of his comrades, and upon looking round for the cause, he saw a lion just in the act of springing on him. He thus graphically describes the situation:—

"I was upon a little height. He caught my shoulder as he sprang, and we both came to the ground below together. Growing horribly close to my ear, he shook me as a terrier dog does a rat. The shock produced a stupor similar to that which seems to be felt by a mouse after the first shake of the cat. It caused a sort of dreaminess, in which there was no sense of pain nor feeling of terror, though quite conscious of all that was happening. It was like what patients partially under the influence of chloroform describe, who see all the operation, but feel not the knife. This singular condition was not the result of any mental process. The shake annihilated fear, and allowed no sense of horror in looking round at the beast. This peculiar state is probably produced in all animals killed by the carnivora; and if so, is a merciful provision by our benevolent Creator for lessening the pain of death. Turning round to relieve myself of the weight, as he had one paw on the back of my head, I saw his eyes directed to Mabalwe, a native school-master, who was trying to shoot him at a distance of ten or fifteen yards. His gun, a flint one, missed fire in both barrels; the lion immediately left me, and attacking Mabalwe, bit his thigh. Another man, whose hip I had cured before, after he had been tossed by a buffalo, attempted to spear the lion while he was biting Mabalwe; he left Mabalwe and caught this man by the shoulder, but at that moment the bullets he had received took effect, and he fell down dead." Livingstone on this occasion got off with one of his bones crunched to splinters, and with eleven teeth wounds in his arm. Now there is every probability that if any other animal had been similarly placed to Livingstone, it would have been instantly despatched. The lion seems to have an instinctive fear of man, even when it has him

in its power, so that the animal hesitates long enough before taking his life to allow any hunter in the neighbourhood to make a diversion in his favour. It seldom attacks man unless provoked, or suffering from intense hunger. At the sight of him in daylight it will halt for a second or two to stare at him; it then slowly turns round and leisurely moves on a few steps; it begins to trot, and finally, when it thinks itself unobserved, it bounds off like a hare. For these reasons the lion has been spoken of as far less courageous than it was formerly thought to be. But it appears to us that the lion's hesitation in attacking man, unless pressed by hunger or other circumstances, detracts in no wise from the estimate that has been formed of it as a bold animal, but rather tends to show that it possesses sagacity in addition to its other qualities. The following incident, narrated by Burchell, appears to prove its courage and coolness under extreme danger and pain, and likewise its discrimination in refusing to fight where the odds against it are

conscious of his strength, remained unmoved by their noisy attempts, and kept his head turned towards us. At one moment, the dogs perceiving his eyes thus engaged, had advanced close to his feet, and seemed as if they would actually seize hold of him; but they paid dearly for their impudence, for without discomposing the majestic and steady attitude in which he stood fixed, he merely moved his paw, and at the next instant I beheld two lying dead. In doing this he made so little exertion that it was scarcely perceptible by what means they had been killed. Of the time which we had gained by the interference of the dogs, not a moment was lost; we fired upon him; one of the balls went through his side just between the short ribs, and the blood immediately began to flow; but the animal still remained standing in the same position. We had now no doubt that he would spring upon us; every gun was instantly reloaded; but happily we were mistaken, and were not sorry to see him move quietly away. . . . Notwithstanding



THE COMMON WILD CAT.

such as to mean certain death. Burchell and his companions were travelling through a bush-covered country in South Africa, when suddenly they came upon a lion and lioness. The latter withdrew, but the lion stood his ground. The situation was a dangerous one, as the animal seemed to be preparing to spring upon the travellers. Burchell thus describes the affair:—

"We were standing on the bank at only the distance of a few yards from him, most of us being on foot and unarmed, without any possibility of escaping. I had given up my horse, and was on foot myself; but there was no time for fear, and it was useless to attempt avoiding him. Poor Tring, a Hottentot woman, was in great alarm; she clasped her infant to her bosom, and screamed out, as if she thought her destruction inevitable, calling anxiously to those who were nearest the animal, 'Take care! take care!' In great fear for my safety, she half insisted upon my moving further off. I, however, stood well upon my guard, holding my pistol in my hand, with my finger upon the trigger; and those who had muskets kept themselves prepared in the same manner. But at this instant the dogs boldly flew in between us and the lion, and surrounding him, kept him at bay by their violent and resolute barking. The courage of these faithful animals was most admirable; they advanced up to the side of the huge beast, and stood making the greatest clamour in his face, without the least appearance of fear. The lion,

the pain of a wound of which he must soon afterwards have died, he moved slowly away with a stately and measured step."

There are many varieties of the lion, which differ in size, colour, and development of mane. It is by slight differences of this sort that the breeds of Barbary, Senegal, the Cape, Bengal, and Persia or Arabia are distinguished. Some attain to a length of ten feet from the muzzle to the root of the tail, but as a rule they do not exceed six to seven feet. The lioness is generally about one-fourth less than the male, and is maneless.

Perhaps the next most important member of the cat family is the tiger, which closely resembles the domestic cat in form and actions. It is of about the same height as the lion, but longer in the body. It has a handsome yellowish fawn-coloured coat, striped with brown bands irregularly on the body, but with remarkable regularity on the face, where, as a rule, the striping is quite symmetrical. Like a great many other animals, it has the ventral portion of its coat white. Its tail is ringed with black.

The tiger is peculiar to Asia and the larger islands of the Asiatic Archipelago, where its fatal attacks both on man and beast make it very much feared. A tiger has been known to carry off soldiers from the middle of their encampment, and to spring on a Hindoo amidst all the bustle of an Eastern fair. Its audacity is unbounded, and so often are its feats attended

with success that it has obtained the reputation of being one of the most bloodthirsty of animals. A tiger hunt is therefore attended with no small amount of danger, and we are familiar with accounts of the hair-breadth escapes and thrilling adventures which Indian sportsmen have encountered in these hunts. Both the lion and tiger are capable of being tamed and trained, and one may occasionally see them being put through their performances in travelling menageries. The tiger, which is slendrier than the lion, is also more active and stealthy in its movements. Stealing from its den at a convenient hour, it proceeds to some place where it can hide; it then springs on the first victim that presents itself, whether it be man or animal. It is said by some naturalists to kill not for the mere pleasure of killing, but for food, not waiting to attack until driven by hunger. The tigress and lioness both exhibit great affection for their young.

The other members of the cat family, although perhaps of equal importance to those we have so far described, have not received so much attention, and we may therefore devote the remainder of the small space at our disposal to a description of some of them. Six of them—the panther, leopard, ounce, serval, jaguar, and ocelot, have spotted coats, differing, however, in the nature and disposal of these spots, as well as in certain other respects. Thus in the leopard the spots are farther apart than in the panther. It is not always easy to distinguish, however, between these two animals, as from their great resemblance one has often been taken for the other, whence has arisen much confusion in the accounts of them. The leopard is much the larger of the two, some having been measured which were as much as seven feet four inches long from the tip of the nose to the root of the tail, while the panther is only about three feet long measured in the same way. There is also a structural difference between the two animals, the tail of the leopard having in it only twenty-two small bones or vertebrae, while that of the panther has twenty-eight. The panther is found in Asia, more particularly in India and Japan, and the leopard inhabits the whole of Africa as well as part of Asia.

The jaguar has been called the American tiger, and the puma the American lion, but however much the former may merit the title of tiger, it would seem that the name of lion is inappropriate when applied to the puma. For the puma by no means equals the lion in size and strength, although it is the largest of American cats. It is more like the lioness in general appearance, but it does not even come up to this animal in size, being little, if anything, over four and a half feet long. It seldom attacks man, but it is very destructive to the native animals and cattle in its vicinity, killing many of them before it commences to feed. It is found in Paraguay, Brazil, Guiana, Mexico, and the United States. The jaguar, measuring close upon seven feet from the end of the nose to the root of the tail, nearly equals the tiger in size, and its habits make it as much feared by the herds of wild animals which graze on the Pampas of South America. Its spotted markings, irregular in shape and on a tawny ground, are most numerous on the head, thighs, legs, and back. It seeks its food in the rivers as well as on the plains, being a good fisher, as well as a mighty hunter.

The serval, ocelot, ounce, lynx, and wild cat all possess the attributes of the cat family, remorselessly taking the life of such animals as they elect to feed on. It seems difficult to see what is the use of all this strife in nature, but we may nevertheless rest assured

"That not a worm is cloven in vain;
That not a moth with vain desire
Is shrivell'd in a fruitless fire
Or but subserves another's gain."

READINGS IN GERMAN.—II.

2. Die kleine Wölkchen.

Das war ein kalter strenger Winter. Da sammelte die kleine Minna, die einzige Tochter wohlthätiger Eltern, die kleinen Schneekugeln, die sie in der Gasse und auf dem Hofe sammelte. Sie war sehr eifrig und fleißig, und sie hatte schon viele Kugeln gesammelt. Sie wollte sie ihren Freunden schenken, die sie in der Gasse und auf dem Hofe sammelte. Sie war sehr eifrig und fleißig, und sie hatte schon viele Kugeln gesammelt. Sie wollte sie ihren Freunden schenken, die sie in der Gasse und auf dem Hofe sammelte.

* The different specimens of these vary considerably, the numbers given are therefore approximations only.

Die kleine Minna sammelte die kleinen Schneekugeln, die sie in der Gasse und auf dem Hofe sammelte. Sie war sehr eifrig und fleißig, und sie hatte schon viele Kugeln gesammelt. Sie wollte sie ihren Freunden schenken, die sie in der Gasse und auf dem Hofe sammelte. Sie war sehr eifrig und fleißig, und sie hatte schon viele Kugeln gesammelt. Sie wollte sie ihren Freunden schenken, die sie in der Gasse und auf dem Hofe sammelte.

Es ist ja Alles mit Schnee und Eis bedeckt, antwortete Ess ist ja mit Schnee und Eis bedeckt, antwortete Ess ist ja mit Schnee und Eis bedeckt, antwortete

Da sagte der Vater: Aber du kannst sie doch nicht alle sammeln! Da sagte der Vater: Aber du kannst sie doch nicht alle sammeln! Da sagte der Vater: Aber du kannst sie doch nicht alle sammeln!

Die kleine Minna antwortete: Thun denn nicht alle Kinder das? Die kleine Minna antwortete: Thun denn nicht alle Kinder das? Die kleine Minna antwortete: Thun denn nicht alle Kinder das?

VOCABULARY.

Wölkchen, f. bene- factress. (Wölk- n. good; adverb, well, perhaps. That, f. deed; That, ter, m. door, actor; -in, affix, to form feminine nouns; thätig, doing, ac- tive, sein, to be.)	Dem, dativem, and n. to the. Mädchen, n. girl, maid. Zittern, to tremble. Vor, with, before. Kalt, f. cold. Befahren, to watch, listen (be, prefix, as be in besmear, makes a verb trans- itive).	Arm, poor. Dahin, therefore (dahin, instead of da, there). Ich, I. Füttern, to feed. So, so. Reich, rich. Mensch, m. man, hu- man being. Unterfliegen, to as- sist (unter, under; Stütze, f. prop). Ernähren, to feed, support. Doch, yet, however. Nicht, not. Versorgen, to supply, provide (Zorgen, to care; ver-, pre- fix, for, before, a- way, astray). Denn, then, for. Ganz, whole. Welt, f. world. Leute, pl. people. Versorgen, pflegen, to support, to nurse. Mutter, f. mother. Maid, f. servant, maid. Heilig, holy. Einfalt, f. simpli- city.
War, was. Kalt, cold. Sammeln, to gather. Eifrig, only. Tochter, f. daughter. Eltern, Eltern, pa- rents, pl. Über, over. Verbleiben, to remain, stay. Bewahren, to preserve, keep. Dann, then. Gehen, to go. Gut, out. Zwei, two; Mal, n. time. Tag, m. day. Hof, m. yard, court, farm. Streuen, to strew. Gerhet up (her, here, hither, indicates motion towards the speaker).	Küßlich, lovely (-lich, affirmative, -ly, -ous, -able, -like). Anblick, m. sight. (Blick, m. look; an- blicken, to look at). Sprechen, to speak. Warum, wherefore (um, for, about). Thun, to do. Du, thou. Das, demonstrative pronoun, that. Ja, indeed, yes, truly. (Es ist ja? is it not?) Schnee, m. snow. Eis, n. ice. Bedecken, to cover. Dahin, conjunction, that. Nichts, nothing.	

KEY TO EXERCISES IN LESSONS IN GERMAN.

EXERCISE 79 (Vol. I, page 382).

1. Die nie zu ergründende Allmacht Gottes. 2. Ich bin hier, anstatt meines Bruders. 3. Das Widersprechen der Polen war verwerfungsstüchtig.

schredlich das Sagen ihres Schicksals. „Noch ist Polen nicht verloren.“ 4. Das Lesen lehrreicher Bücher vermehrt den Verstand. 5. Den Armen beizustehen ist eine christliche Pflicht. 6. Der Wechsel der Zeiten und Jahreszeiten, und das Abgehen und Kommen der Könige, gehört allein der Verführung an. 7. Er verteidigt diesen Mann, ohne ihn zu kennen. 8. Die Gefahr erhöhte den Muth der Soldaten, ankant ihn zu bringen. 9. Der Schüler lernt das Zeichnen und Malen von seinem Bruder. 10. Diese Weise zu leben bestimmt mir nicht.

EXERCISE 80 (Vol. I, page 383).

1. Have you heard also that I fell from my horse? 2. No, I heard you had fallen out of the carriage. 3. History mentions that Tilly, who took Magdeburg in the Thirty Years' War, acted very barbarously. 4. My brother said you had been much praised. 5. Frenchmen assert that they are the most educated people in the world. 6. Your sister thought you had been in the town. 7. Englishmen are of opinion that they are the masters of the sea. 8. This traveller said he had been twice at Rome. 9. He hopes he shall be at Dresden in a week. 10. You fear you have been too slow in acting. 11. We thought you were in the country. 12. I think we should have come to you yesterday if the weather had been finer. 13. I thought he had been mindful of his parents' warning voice. 14. He told me indeed he was ill, but many declare it was dissimulation on his part. 15. His relations say his prosperity has brought on his misfortune. 16. I heard with regret that you had had the nervous fever. 17. Being up-stairs (in the upper room), I did not hear you call. 18. They say the Hungarian faithfully defended his country until his death. 19. I heard this young Frenchman would inherit a great fortune. 20. I believe that many people will have had their happiness here on earth.

EXERCISE 81 (Vol. I, page 383).

1. Man sagt, diese Herren seien betrunken gewesen, aber sie irren sich. 2. Man sagt, daß der Aufenthalt in Paris angenehmer sei, als in London. 3. Wir konnten nicht glauben, daß dieses wahr sei. 4. Man glaubt allgemein, der Feind habe die Grenze überschritten. 5. Er behauptete, daß es besser wäre, zu Hause zu bleiben, als auszugehen. 6. Ich wollte, daß er mit mehr Liebe behandelt würde. 7. Er sagt Petermann, daß Sie ein sehr reicher Mann seien; aber wenn Sie es wären, so würden Sie nicht so sparsam sein. 8. Haben Sie auch gehört, daß Ihr Freund vom Pferde gefallen sei? 9. Nein, aber ich habe gehört, er sei aus dem Wagen gefallen. 10. Ich hoffe, Sie werden in vierzehn Tagen bei Ihren Eltern sein. 11. Ich glaube, daß er so untauglich sein kann. 12. Dieser Fremde sagt, er sei gewirmt in Italien; und auf seiner letzten Reise sehr krank gewesen.

EXERCISE 82 (Vol. I, page 402).

1. Do you like to see my brother-in-law? 2. Yes, I like to see him. 3. Uncle would like to see your drawings. 4. I like to have friends near at hand. 5. In my youth I was fond of studying, but now I take no pleasure in it. 6. He is fond of talking of his travels and what he has met with. 7. If you need the books, I will lend them to you with all my heart. 8. He does not like to separate himself from his family. 9. I like a warm room. 10. Can you row us safely over this stream? 11. No, we are not able, for this boat is too small. 12. If you are able to translate these newspapers, do it. 13. As I understand the English language perfectly, I will gladly accept your proposal. 14. If he is able to do the work well, he may come to me; but if he is not able, it would be useless. 15. He did not believe that I was able to execute all his commands. 16. If thou knowest how to govern all thy passions, thou art to be envied. 17. My friend Edward was so weak that he was not able to walk alone, and therefore he asked me to conduct him. 18. He thought no one was able to write on this rough paper. 19. He was in want of money yesterday, consequently he asked me if I would give him some. 20. It is true, he already owes me several dollars; but as he was in need of the money, I gave him some. 21. No one is able to go out, because it rains too hard. 22. He will soon be able to complete his work. 23. He cannot keep his word, and for the following reasons.

EXERCISE 83 (Vol. I, page 403).

1. Wenn er nicht im Stande gewesen wäre, die Arbeit zu thun, so würde er sie nicht unternommen haben. 2. Wird er im Stande sein, sein Versprechen zu erfüllen? 3. Er ist es nicht im Stande gewesen. 4. Wir sollen nicht mehr versprechen, als wir im Stande sind, zu erfüllen. 5. Sind Sie im Stande, eine bessere Erklärung von diesem Gegenstande abzugeben? 6. Ich bin es wohl im Stande, aber ich habe jetzt keine Zeit. 7. Golt der Anabe meinen Sted gern? 8. Wenn er es thut, so ist es ungern; ich würde lieber selbst gehen. 9. Sehen Sie Ihre Verwandten gern? 10. Ja, ich sehe sie gern. 11. Wenn Sie diese Bücher nötig haben, so leihen ich sie Ihnen gern. 12. Er hatte gestern Geld nötig, deshalb hat er mich, daß ich ihm einiges geben möchte. 13. Da Sie sehr so viel schulden, so ist es unnütz, um mehr zu bitten. 14. Wer möchte nicht gern die Wunden eines kranken Herzens heilen!

EXERCISE 84 (Vol. I, page 403).

1. I might have spared myself many an annoyance before now, if I had been silent instead of contradicting. 2. I should like to know

what you would have done if you had been in my place. 3. If misfortune had not visited me, I should hardly have come to these opinions. 4. He might have been happy, if he had known how to make use of the opportunity. 5. If the water had carried the bridge away, the toll-gatherer would have been lost. 6. If I had been able to come to you, I should certainly not have remained here. 7. Great men would never have appeared, if they had allowed themselves to be kept back by difficulties and troubles. 8. If I had resolved to attain what I wished, I should have had to work more diligently and perseveringly. 9. If he had called, I should have heard him. 10. We will not go out, it might rain. 11. If you would communicate to me some particulars about these affairs, you would very much oblige me. 12. It would be my greatest joy to see all men happy. 13. I must have been without sense, if I had engaged myself in these affairs. 14. The shore has vanished in the distance; O how I long to be in my fatherland! 15. If he were as I wish (him), and if he had answered all my requirements, I should have kept him.

EXERCISE 85 (Vol. I, page 403).

1. Wäre Ihr Freund nicht unwohl gewesen, so würde er gewiß das Fest durch seine Gegenwart verschönert haben. 2. Wenn Sie klüger wären, so würden Sie diese Unannehmlichkeit nicht erfahren haben. 3. Ich würde Ihr Geschäft in Ordnung gebracht haben, wenn Sie es mir gefügt hätten. 4. Sein Bruder würde besser empfangen werden sein, wenn er Empfehlungsbriefe gehabt hätte. 5. Er würde bessere Freunde haben, wenn er angesehener wäre. 6. Sie würden mehr Schwierigkeiten gehabt haben, wenn Sie dem Rathe Ihrer Freunde nicht gefolgt wären. 7. Ich würde nicht den geringsten Zweifel haben, daß es Ihnen gelungen wäre, hätten Sie klüger gehandelt. 8. Wir würden nach Holland abgehen, wenn wir günstigen Wind hätten. 9. Er würde der erste unter unsern Kaufleuten sein, wenn er gefälliger wäre. 10. Wenn ich die Nacht gehabt hätte, so würde ich anters gehandelt haben, denn ich würde nicht so viel Geld gehabt haben. 11. Was würde die Glückseligkeit des Menschen sein, wenn er sein Glück immer in sich selbst suchte? 12. Sie würden reicher sein, wenn Sie unternehmerischer wären. 13. Wenn ich meine Werte nicht verloren hätte, würde ich sie noch haben. 14. Er würde nicht so viel Geld haben, wenn er faul gewesen wäre. 15. Je größer die Schwierigkeit, desto größer ist das Vergnügen sie zu überwinden. 16. Wenn er nicht über die Brücke gegangen wäre, würde der Zöllner keine Bezahlung verlangt haben.

EXERCISE 86 (Vol. II, page 26).

1. Can you not remember the day of my arrival? 2. O yes, I still remember it very well. 3. There are many people who are more disposed to remember their bad than their good actions. 4. It is difficult to convince him of the truth of this narration. 5. It is sometimes very difficult to believe what we cannot comprehend. 6. It is hard for the poor but industrious man to be obliged to claim the assistance of strange people. 7. The English language is more difficult to me than the French. 8. With his money, his relations, and his knowledge, it was not difficult for him to obtain a good as well as an agreeable position. 9. Why does your brother learn so much quicker than you? 10. Because he has a better memory, and can retain the words better. 11. Can you not remember to whom you have given the books and the paper? 12. I cannot remember anything about it. 13. The idler cannot remember the rules, because he does not thoroughly learn them, and likes play better than work. 14. Theft is a crime. 15. He placed a dollar in the poor man's hand. 16. We gladly remember friends at a distance. 17. Young people sometimes wear spectacles in order to appear learned.

EXERCISE 87 (Vol. II, page 26).

1. Erinnern Sie sich des Tages der Ankunft Ihres Bruders? 2. Ja, ich erinnere mich des Tages sehr wohl. 3. Die meisten Menschen erinnern sich der Jahre ihrer Jugend mit Vergnügen. 4. Es giebt viele, die sich ihrer Leidenhaftigkeiten mit Scham erinnern. 5. Es ist schwer, alle Regeln einer Sprache zu behalten. 6. Es ist nicht so schwer, einen Gelehrten zu überzeugen, als einen Ungelahrten. 7. Es ist schwer, sich den Schicksalen des Lebens zu unterwerfen. 8. Ja, es ist sehr schwer; aber der denkende Mensch überwindet sie. 9. Können Sie sich nicht erinnern, wenn Sie mein Buch geliehen haben? 10. Nein, ich erinnere mich dessen nicht. 11. Lügen ist eine Sünde.

EXERCISE 88 (Vol. II, page 27).

1. He who does not esteem old people, is not worthy to be esteemed himself. 2. If a person resolved to notice every speech, he would have to trouble himself about many things. 3. He was in want of the means necessary to carry out his plans. 4. Who will take care of me when I am forsaken? 5. When he repents of his faults, then will I, too, think no more of them. 6. I should still need many more things, if I were not accustomed to dispense with articles which many people think indispensable. 7. The general mentioned your son as one of the bravest men in his regiments. 8. Grant me my petition, O Lord, and protect me from my enemies. 9. Remember my petition. 10. Nothing is more insupportable than to wait long for some one, who, at last, does not come at all. 11. I was anxiously waiting a long time for you, when I at last saw you come. 12. Take pity on the child

that runs forsaken in the street. 13. If the prince were grieved for the people, he would govern differently. 14. But the people will still reward him for it, and then not spare him. 15. It would be indeed worth while to travel to California. 16. I should like to spare these clothes, if I had others. 17. I wish to die no other death than the death of decrepitude. 18. Do not forget my words. 19. Forget the pains that have been endured, but forget not the pleasures enjoyed. 20. If the princes could, they would spare neither the liberty nor any one right of their people.

EXERCISE 89 (Vol. II., page 27).

1. Sie pflegte ihres Vaters in seinem Alter und pflegte mich, da ich das Nervenfieber hatte. 2. Er spottete meiner, und bemerkte nicht, wie die Menschen über ihn spotteten. 3. Hat er mein Geschenk angenommen? 4. Nein, er sagte mir, er bedürfte dieses Gescktes nicht. 5. Erwähnen Sie nicht seiner Güte. 6. Der Lehrer darf über Nachlässigkeit und Unaufrichtigkeit seiner Schüler nicht schweigen, sondern muß sie streng verweisen, wenn er jene wahrnimmt. 7. Bergeißt nicht die warnende Stimme eurer Eltern. 8. Geben Sie des Sabbaths. 9. Wer kann einem Menschen glauben, der über alles spöttelt, und der Seemanns spöttelt. 10. Wir erwarteten mit Sehnsucht die Ankunft unserer Freunde. 11. Wenn du keine Fehler bereueßt, dann werde ich mich keiner mit Freuden erinnern. 12. Gewissenhafte Leute halten keine Eiden Riten, noch kränken sie sich mit Eigenschaften, welche sie nicht besitzen.

EXERCISE 90 (Vol. II., page 62).

1. I am unaccustomed to such work, and should not do it if I were not in want of money. 2. I am in want of a great sum of money; do help me, I am certainly not unworthy of your assistance. 3. If he were mindful of my kindness, he would not act so. 4. This man is so bad, that I consider him capable of any action. 5. Do you think the covetous man can enjoy his life? 6. I shall really be willing to confess my deed, only let me go! 7. The hunter was so sure of his prey, that he spent the price of the bear's skin in drink, before he had shot him. 8. Let me go now, I am heartily tired of your gossip. 9. Well, if you are tired of me, I will go. 10. Never will I be guilty of a deed which would render me unworthy of your friendship. 11. I possess a farm, but being unaccustomed to working, and unacquainted with agriculture, I am tired of it. 12. One is worthy of the other, but one is also often unworthy of the other. 13. A king who does not love his people is unworthy of the throne. 14. Although you suspect me of the deed, still I cannot confess it, because I have not committed it. 15. If men were always mindful of death, they would not so often be guilty of wicked deeds. 16. Help thy neighbour, and ask not if he is worthy of thy help, when he is in want of it. 17. I will accompany you, for I am acquainted with the road, and see you are unacquainted with it. 18. I thank you, sir, I am not in want of your service; for as I am tired of walking and weary of riding, I shall remain here. 19. In America, what does the man do who is not accustomed to any kind of work? 20. He must become accustomed to work, and be mindful of the adage—"He who does not work shall not eat."

LESSONS IN GEOLOGY.—II.

STRATIFIED ROCKS—UNSTRATIFIED ROCKS—STRATA—DIP—POSITION OF STRATA—DIP OF STRATA—CLINOMETER.

A VERY casual acquaintance with the appearance of the rocks which compose the surface of the earth will be sufficient to induce the observer to divide them into rocks stratified and unstratified. Stratified rocks—as the derivation of the word indicates (*stratum*, "that which is spread out")—have the appearance of having been laid in layers one above the other. Sometimes these layers are horizontal and perfectly flat. This is notably the case in the vast plains of Russia, where some of the very earliest deposited rocks—the Silurians—have retained the position in which they were formed for ages, notwithstanding the repeated and often violent changes which have in other regions affected the earth's crust. Most frequently, however, the strata exhibit flexures, and are more or less inclined to the horizon; in some cases—as in the coal measures in the Mendip Hills, in Somersetshire—they are even vertical, and instances are not wanting in which they have been absolutely turned over.

Abundant evidence is given to show that all rocks exhibiting stratification have been deposited by aqueous action—that is, that their particles were once mixed with water, and gradually sank to the bottom of the sea or lake, where, in process of time, they became solidified, and appeared on the surface, either by the draining off of the water or by the elevation of the bed.

Unstratified rocks are those which appear in amorphous masses (*a*, without, and *morphe*, form), that is, which exhibit no marks of stratification. Granite is a well-known specimen of such rocks. If excavations on the earth's surface be carried deep enough, these rocks are invariably reached—hence they are

called "primary," or rocks first formed. They are supposed, as stated in the last lesson, to be the cooled product of the molten mass of which the earth was composed when it condensed from the "fire-cloud." However, it is but right to state that much diversity of opinion has existed concerning their origin, whether they ever were fused. This question will be alluded to in a future lesson on the Primary Rocks.

The products of volcanoes, which are frequently found embedded in stratified rocks, are termed *Plutonic*, to distinguish



Fig. 1.—1. GRAVEL. 2. SAND. 3. MUD.

them from the members of the primary groups, which do not seem to have been the result of volcanic action, but are due to a much more universal agency.

The various positions in which rock strata appear, the mode in which the all but universal disturbance of strata has occurred, and the manner in which igneous rocks—primary and Plutonic—have been injected through the strata, as well as the explanation of the technical geological expressions, will be at once comprehended by studying the diagrams in this lesson.

The simplest form of deposition of strata is that which is taking place at the bottom of lakes. Here there are no disturbing currents, no eddies, no tides, and the only cause which could in any way modify this uniform distribution of debris (waste or worn material) brought down by the river would be the state of the river itself—whether it were flooded or not. The nature of the sediment must entirely be determined by the mineral character of the rocks of the country drained by the river. For instance, the colour of the Mississippi is not the same as that of the Arkansas and Red River. The mud which the Indus brings down is of a clayey hue, while that of the Chenab is reddish, and of the Sutlej paler. So that from the deposit of a river the geological character of the country it drains may be determined. From the sediment with which the Nile fertilises Upper Egypt the nature of the distant mountains, whose melting snows feed the flooding river, is plainly indicated.

The debris carried down by a river may be conveniently divided into three classes of matter—(1) gravel, which is composed of water-worn pebbles; (2) sand, which is of the same material as the pebbles, but in grains; and (3) mud or silt, which is a further subdivision so as to render the particles impalpable—of such sediment is clay composed. It is evident that the gravel, being the heaviest, will be deposited nearest to the embouchure of the river, the sand would overlie this, while the mud would be carried far out into the still water, and gradually settle to the bottom. This is depicted in Fig. 1.

It is evident that upon the occasion of an extraordinary flood in the river the gravel will be larger, and will be carried

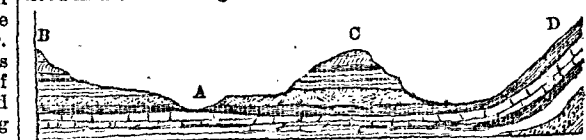


Fig. 2.

further—so will the sand, which will be coarser, and will encroach on the area hitherto covered only by mud; thus we are able to account for those layers of coarse grains which frequently appear in a sandstone. Let the reader carefully scrutinise the stones of a wall, and he will at once find many examples of this. The area of deposition in a lake is necessarily very limited, hence the strata formed cannot be extensive, but where this process goes on in the sea enormous tracts are covered with sediment. For example, the waters of the Amazon colour the ocean for a distance more than 300 miles from land; that is, there is a layer of sediment now being deposited which in after ages may appear as a vast horizontal stratum.

Though all aqueous rocks must when deposited have been horizontal, yet when uplifted to the surface they submitted to various kinds of disruptions and displacements, and not only

so, but the surface of the earth need not be uniformly level, even where the strata yet remain in their horizontal position. Thus, in Fig. 2, the river, A, has worn down and carried away six layers of strata, and is in the act of cutting into the seventh. A similar action has denuded the country to the right of the hill, C, which is thus composed of strata still in their original position, and which are found in a corresponding position on the hill, B. After the denudation had been completed in the neighbourhood of D, an upheaving force tilted the strata, throwing them out of their position and producing a hill, by very different means from those to which C owes its existence. The valley formed by the river between the hills B and C would be styled a valley of denudation.

When the subterranean force acts upon strata which has not room to obey its impulse, the strata become crumpled as easily as the leaves of a book borne down by a weight upon their edges. This phenomenon is illustrated in Fig. 3, where the sedimentary strata abut upon the granite mass A, at B; the contortions are numerous, but many instances no less remark-

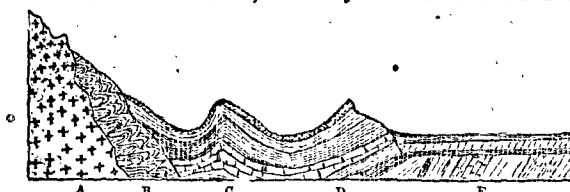


Fig. 3.

able are known; one is well exposed on the Rhine, where the Drachenfels wall in the river. At C, the whole series of strata has bent in accordance with the pressure, forming a saddle-back or anticline (*anti*, opposite, and *clino*, I bend), because the strata dip in opposite directions from the summit of the hill on whose crest runs the anticlinal line. The Swiss Jura may be quoted as a specimen of the formation sketched at C. These mountains are composed of three such anticlines running in parallel ridges. The valleys between B and C and C and D would be called valleys of elevation. At D the strata would be said to outcrop. If the outcrop be a bluff, bold cliff, it is termed an escarpment. The angle which the direction of the strata makes with the horizontal line is called the dip. The line of the outcrop is termed the strike, that is, the direction of the face of the hill as seen from the plain E. It is necessary also to determine not only the angle of the dip, but the direction of the dip, which will evidently be at right angles to the strike; that is, if the strike run north and south, then the direction of the dip will be east and west.

When strata lie evenly upon each other and parallel, they are said to be conformable; but when such an instance as E occurs, where the overlying strata are not parallel to those beneath, but have been deposited after the disturbed strata had assumed their new position, they are then said to be unconformable.

It may easily be imagined that sometimes the strata is too brittle to permit of a bend such as C, it then breaks on the crest of the ridge; this cleft becomes water-worn, forming a valley running along the top of the mountain. An example of this is also furnished in the Jura range.

The modes in which the unstratified rocks are found associated with those of aqueous origin are either in disrupting, interstratified, or overlying masses.

In Fig. 4 the strata has been opened at C, and the fissure

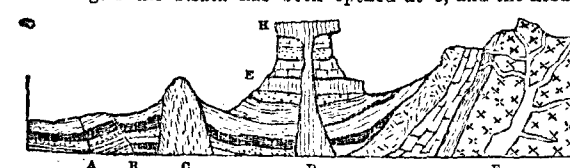


Fig. 4.

filled from below with molten rock. This was much harder than the stratified rocks around it, which succumbed to the action of water, and became degraded, leaving the mass of hard igneous rock standing out of the ground like a wall; hence such phenomena are termed dykes. At E is figured a specimen of

an interstratified igneous rock. The molten matter was ejected over the floor of the ocean at a time when sediment was in the course of deposition, strata accumulated over this mass, and then another eruption broke through E and its overlying strata, pouring out another layer of unstratified rock; when the whole was raised from the ocean bed and submitted to the denuding action of water, the hard bed H preserved the softer underlying strata; the water having but little action on E, left it exposed, running along the side of the hill as a terrace. It often happens that several of these igneous layers thus appear one above the other, and for this reason have acquired the name of trap rocks (from the Swedish word *trapp*, a stair).

At F is shown a smaller fissure, whose ramifications pass through stratified and unstratified rocks. Such fissures are usually filled with mineral ores; they then are called lodes (from the Saxon *lode*, a course) and veins.

The irruption of igneous rocks necessarily produces dislocation of the strata through which they pass; when the angle of the dip alters, as at A, a fault is the result. But if the continuity of the strata be broken, as at B, then a slip is said to have been caused. These faults and slips are of vital importance to the miner, as sometimes the seam of coal or the metalliferous vein has slipped practically beyond his reach.

The facts which have now been described are applied to draw geological sections of countries and localities in the following manner. It is impossible to trace a bed of rock through the whole of its development; we meet with it here and there—at the sea-shore—in a railway cutting—in a quarry, or in some ravine where a stream of water has worn its way; at these different points we take its bearings, and then complete the section from our knowledge of the general flexures which strata undergo.

The observer must carry with him a compass and a clinometer. This latter instrument may be a quadrant of cardboard, the edge of which is divided into 90 degrees. A piece of slight wood is fastened with a pin to the angle of the cardboard, which is placed in the direction of the dip of the strata by the eye; a plumb-line, also attached to the pin, will show when the upper edge of the clinometer is horizontal. The angle between this upper edge and the rod is the dip of the strata. A clinometer is given in Fig. 5. They may be bought with a compass attached to them and a spirit level, so made as to fold together into a small space.

Thus provided, the expedition may be commenced. The notes of the observations are registered, as in Fig. 6. The observer is

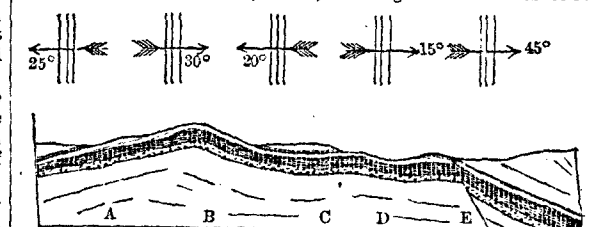


Fig. 6.

guided by his compass to walk along the same direction, say from south to north. He finds the strata at A dipping southwards at an angle of 25°; a few miles further, after passing the crest of a slight eminence, the strata is again exposed at B in a quarry and here the dip is changed to northwards and the angle to 30°. Again at C an observation is made, where the dip is southwards, and the angle 20°. Hence between B and C the strata evidently form a basin, the steeper side being at B. At D the dip is again northwards at a small angle, when suddenly at E the angle is greatly increased, while the direction of the dip remains the same. This could only be accounted for by supposing that somewhere between D and E the strata had been dislocated, and a fault produced.

From these observations the section represented may be drawn. The three parallel lines at A, B, C, etc., indicate the direction of the strike.

LESSONS IN ITALIAN.—II.

II.—PRONUNCIATION OF VOWELS AND CONSONANTS.

I now proceed to explain Italian pronunciation in a method of recent adoption by some ingenious teachers of Italy, by which all the combinations of the vowels and consonants, and consequently all the ingredients and component parts of the language, will pass under the eye of the reader. Let him learn from the very beginning of his labours to pronounce each syllable of the following words and tables, and he will soon acquire a correct method of pronunciation. No word or combination of words can offer any difficulty to him, because he will have mastered the component parts of all words in these tables.

The Italian language has five vowels, representing seven sounds:—

- I. *a*, invariably sounded like the English interjection *ah*.
- II. *i*, invariably sounded like *ee* in *see*.
- III. *u*, invariably sounded like *oo* in *too*.
- IV. 1. *e*, invariably sounded like *ay* in *say*, but with a slight opening of the mouth only, and with an elevated and clear tone. It is called, on that account, the close sound of the vowel.
2. *e*, invariably sounded something like *e* in *let*, *set*, and the first *e* in *every*, but with a wide opening of the mouth, and with a deep sound. It is called, on that account, the open sound of the vowel.
- V. 1. *o*, invariably sounded with a medium sound between *o* and *oo*, which has no equivalent in the English language, but which may be easily caught by the ear from hearing an educated Roman or Tuscan speak. Perhaps an approximation is the *o* in *bone*, *hole*, and *note*, but with a slight opening of the mouth only, and with an elevated and clear tone. It is called, on that account, the close sound of the vowel.
2. *o*, invariably sounded something like *o* in *lord* and *orange*, but with a wide opening of the mouth, and with a deep sound. It is called, on that account, the open sound of the vowel.

The first sound of *e* and the first of *o* occur in the majority of syllables, and may be called the ruling sounds of those two vowels. No distinguishing sign is used in Italian to mark the two *e*'s or two *o*'s. Englishmen must have some mark to indicate when *e* and *o* are to be sounded with their second or open sounds. I shall, in these cases, place on *e* and *o* this sign "´", as for example, *e´*, *o´*.

The pronunciation of what, for the sake of distinction, I shall denominate the *circumflexed* sounds of *e* and *o* is not uniform throughout Italy; but as the pronunciation of Rome and Florence is the standard, all departures from it may be reckoned by our students as provincialisms, which ought to be carefully avoided.

The Italian consonants, seventeen in number, are divided into mutes and semi-vowels. Mutes are those that require a vowel after them to render them pronounceable. Semi-vowels are those which require a vowel before them to make them pronounceable.

Let me first enumerate the mutes, and show by tables their combinations with vowels in Italian words. There are ten mutes:—

- I. *b*, named in the alphabet *bec*.
- II. *c*, named in the alphabet *chee*, and sounded like *ch* in *church* before the vowels *e* and *i*. Before all other vowels it is sounded like *k* in English.
- III. *d*, named in the alphabet *dee*.
- IV. *g*, named in the alphabet *jee*, and sounded like *g* in *ginger* before the vowels *e* and *i* only. Before all other vowels it is sounded like *g* in *gang*, *go*, and *gull*.
- V. *j*, named in the alphabet *i* (*ee*) *tungo* or *jota* (*i* consonant), and sounded like *y* in *yes* only at the commencement of a word or syllable and before a vowel. At the termination of a word it is no longer a consonant, but must be sounded like a prolonged or lengthened *ee*.
- VI. *p*, named in the alphabet *pee*.
- VII. *q*, named in the alphabet *koo*. It is an auxiliary letter, only used before *u* with the sound of *k*.
- VIII. *t*, named in the alphabet *tee*.

IX. *v*, named in the alphabet *vee* (*u* consonant).

X. *z*, named in the alphabet *tsaita*, sounded like *tz* in *Switzerland*, or like *dz* in *adze*. These sounds vary in different parts of Italy. After *l*, *n*, and *r*, it is generally pronounced like *tz* in *Switzerland*. The same sharp sound occurs in words derived from Latin, and ending in *zia*, *zio*, *zione*, etc.

I shall mark each word in the following pronouncing tables, and indeed each word given as an example or illustration, with an accent, which, being merely arbitrary, used for the occasion to facilitate the progress of the English learner, and not used in Italian printing, I denominate the *accent of tone*. In every Italian word composed of more than one syllable, there is always one syllable on which, when we pronounce it, the voice ought to pause with a marked elevation of tone. This prolongation and elevation of the voice on the syllable is similar to the transition of the voice from one tone to another in music, in order to descend to the level of the original tone from which the voice was raised. The accent of tone exists more or less in every language, but it is more or less sensibly marked in one language than another, and it is strongly so in Italian; and on the marked use of this accent in a great measure depends the harmony of the language. I shall mark this accent by the acute sign ("´"), from right to left. It is true that this sign is sometimes printed in Italian words, but in a very few instances only, which I shall have occasion to point out hereafter. The *grave accent* ("`"), from left to right, is used much more frequently (the rules for its use will be given hereafter), and for this reason I prefer using, in order to avoid confusion, the acute accent as the arbitrary mark or sign of the accent of tone. Two-thirds of the Italian words have an accent of tone regulated by principles clear and invariable; which it would be inexpedient to lay down now, as they would not at this stage of our progress be thoroughly understood, but which I shall take occasion to point out in convenient places as I proceed.

One remark more with respect to the vowels *e* and *o*. I have called the first sound of *e* as *ay* in *say*, and the first sound of *o* (the medium sound between *o* and *oo*, which cannot be adequately marked by an English equivalent) the ruling sounds of those vowels. The reason is this: they are heard in all syllables, without distinction, whether they have the accent of tone or not; while the second sound of *e* (pronounced with a wider opening of the mouth and a deeper sound, and something like *e* in *let* and *ever*) and the second sound of *o* (also pronounced with a wider opening of the mouth and a deeper sound, and something like *o* in *orange* and *lord*), can only be heard in accented syllables, of which there can be in each word only one. The former sounds, therefore, are much more frequent than the latter; because unaccented syllables are more numerous than those accented.

With regard to the *e* in unaccented syllables having an English equivalent in *ai* or *ay*, I shall have no difficulty in marking the pronunciation; but with regard to *o* in unaccented syllables, as there is no equivalent, I should be obliged to use the acute accent, and thus confuse the reader, who would perhaps be unable to determine which was the accent of tone in a word and which the accent marking the peculiar sound of *o*. I beg it therefore to be understood once for all, that where I shall have occasion to use an *o* in unaccented syllables without any sign above it, the vowel must invariably have the first sound of *o* as above explained. I follow the authority not only of the educated classes of Florence and Rome, but also that of Celso Cittadini and the best theoretical writers on Italian pronunciation.

FIRST PRONOUNCING TABLE,

showing the combination of vowels with mute consonants in natural order.

Italian.	Pronounced.	English.
Bado	bah-do	I take care.
Bevo	bai-vo	I drink.
Bica	bai-tchai	Beatrice, a woman's name.

The reader must not forget my previous observation that *e* before *c* and *i* is sounded like *ch* in the English word *church*.

Bece (for *vece*) bai-tchai Voice, word.

The acute accent over *o* marks not only the accent of tone, but also the first sound of *o* as stated before.

Buco	bao-ko	Hole.
Ebano	ebah-no	Ebony.

Once for all, I must refer my readers to the opening explanation, where I stated that there is no English equivalent to the second, open or circumflexed sound of the *e*, as in the first syllable of *ebano*. For that reason, I have not attempted to imitate it by an English sound; and have therefore simply marked it by the circumflex sign. In all cases of the *e* circumflexed, the reader must studiously avoid the English sound of *e*, which would only create the greatest confusion. He may always bear in mind what I have stated, that an approximation to the circumflexed *e* is to be found in the *e* of the English words *let* and *ever*; only uttered with a wider opening of the mouth and a deeper sound. The circumflexed *e* is invariably the accent of tone.

Abeto	ah-bé-tai	Fir-tree.
Abile	ah-bec-lai	Abile.
Obolo (Latin, obolus)	o-bó-lo	Earthling.

The reader must bear in mind, that this is the second or less frequent sound of *o*, something like the English *o* in the words *orange* and *lord*, but with a wider opening of the mouth and a deeper sound. I give it the circumflex mark, because it is the less common sound. Wherever it occurs in my lessons, it will invariably denote, as in the case of the circumflexed *e*, the accent of tone as well as the peculiar sound of the *o*.

I shall have occasion to speak of the two sounds of *s* when I explain the sounds of the semi-vowels.

Babbo (Tuscan)	bahb-bo	Papa.
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It is a fundamental rule of Italian pronunciation that double consonants must be uttered and vibrated distinctly. This is essentially necessary, not only as it augments the beauty and marks the orthography of words, but as it frequently distinguishes words of totally different meaning, but differing only in spelling by the single consonant instead of the double one; as, for example, *cavo*, dear, and *carro*, a car; as I shall have occasion later more fully to illustrate. Where a or any other vowel precedes a double consonant, a particular stress must be laid on that vowel, and its sound must be shortened. I have not attempted, to indicate that shortening of the sound of the vowel by any new sign, because a frequent change of sign only creates confusion, and the true pronunciation is obvious from the necessity of giving a vibrating clearness to the double consonants.

Bebbe (for <i>bevere</i>)	béb-tai	He drank.
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The English *e*, whenever it is sounded as in the word *get*, corresponds to the shortened sound of the first sound of *e* (*ai*).

Gibbi (for <i>gobbi</i>)	jib'-bae	Hunchbacks.
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The reader must not forget my previous observation that *g* before *e* and *i* is sounded as in the English word *ginger*.

Goble	gib-bo	A hunchback.
Dubbi	dub-bee	Doubts.
Cado	kah-do	I fall.
Cecino	tchai-tché-no	A wild swan.
Cito	tché-to	Quickly.
Coda	kó-dah	Tail.
Cute	kó-tai	Skin.
Ducato	doo-kah-to	Dukedom, ducat.
Gicervo	rec-tchai-vo	I receive.
Incido	in-tché-do	I cut.
Ancona	an-kó-na	Ancona.

It is obvious that not only before double consonants not in the same syllable, but even before one consonant in the same syllable, a or any vowel must be shortened in the Italian, as perhaps in any other language. It is therefore unnecessary to use any sign.

Lacuna	lah-kó-nah	Pool, swamp.
Bacuo	bák-ko	Bacchus.
Becco	bák-ro	Beak.
Picca	pik-kah	Spear.
Rocca	bók-kah	Mouth.
Suoco	sók-ko	Juice.
Dado	dáh-do	Die for gaming.
Devo	dai-vo	I ought, I must.
Dio	dai-to	Finger.
Dopo	dó-po	After, afterwards.
Duce	doo-tchai	General.
Edace	ai-dáh tchai	Gluttonous.

Adelo	ah-dé-lai	Adeline, a woman's name.
Adiro	ah-dé-ro	I provoke to anger.
Adoro	ah-dó-ro	I adore.
Aduno	ah-dó-no	I unite, I assemble others.
Adda	ahd-dah	The river Adda.
Edda	éd-dah	The Edda of Scandinavian
Iddio	Id-déo-o	God. [literature.]
Adduco	ahd-dó-ko	I lead to.
Gaza	Gáh-dzah	Gaza in Palestine.
Geto	jé-to	Jess (in falconry).
Gita	jé-tah	A walk, trip.
Godo	gó-do	I rejoice.
Gufu	gú-fo	A horned owl.
Legame	lai-gáb-mai	A tie, ligament.
Angelo	ahn-jai-lo	Angel.
Angina	ahn-jé-nah	Inflammation of the throat.
Vigore	vee-gó-rai	Vigour.
Arguto	ahr-gó-to	Ingenious, witty.
Paggi	páh-jee	Pages (attendants).

The pronunciation of *gg* depends on the vowel that follows the latter *g*. If that vowel is *e* or *i*, the *gg*'s are pronounced somewhat as if the first *g* had merely the sound of *d*; and the second *g*, which goes to the next syllable, like the English *j* in *jay*, only the voice must not pause too long on the *d* of the syllable where the first *g* occurs; the stress must be laid on it, and the voice must glide as quickly as possible to the pronunciation of the second *g*, which must be very soft. In this way there will be effected a more equal distribution of the sound *j* between the two syllables, which will produce the correct sound of the *gg*.

GREAT BOOKS.

XII.—GIL BLAS.

NOVELS of roguery, of which Le Sage's "Gil Blas" is a conspicuous example, were at one time much in vogue, and indeed the taste for such productions underwent a revival at no very distant date. The Romans had some fictions of this nature, which probably set the fashion to more modern writers; but among the latter the Spaniards have especially distinguished themselves. One of the earliest of the Spanish romances of sharpening was that which professed to record the life and adventures of Lazarillo de Tormes, written in the early part of the sixteenth century, probably by Don Diego Hurtado de Mendoza, though it has also been attributed to Juan Ortega. This story depicts with great vividness the state of society in Spain at a period when manners were beginning to be affected by the extraordinary influx of precious metals from the New World;—a state of powerfully-contrasted wealth and poverty, and of vicissitudes so sudden and extreme that the *hidalgo* of to-day might be the beggar of to-morrow, while the beggar might be exalted to a condition of prosperity. At the close of the same century—in 1599—Mateo Aleman published his "Guzman de Alfarache," which exhibits a development of morals even worse than what is painted by Mendoza. Spain had by that time been fully debauched by an inflated prosperity, and the country swarmed with adventurers and swindlers, many of whom were to be found among the better classes. Quevedo followed, in the first half of the seventeenth century, with his "History of Paul the Spanish Sharper, the Pattern of Rogues and Mirror of Vagabonds." Stories of this kind went by the general name of *Picarescos*—that is to say, rogues' novels; and they divided the public favour with romances of chivalry and of so-called pastoral life. Even in "Don Quixote" we have a little admixture of this element; but it is subordinate to other matters.

These works were the precursors, and to some extent the progenitors, of "Gil Blas." The author of that celebrated fiction, Alain-René Le Sage, was a Frenchman, born in 1668, and living until 1747; but this particular novel exhibits so close a familiarity with Spanish life, and is so thoroughly imbued with the Spanish nature, that some writers declare it must really have originated beyond the Pyrenees. Natives of the Peninsula are a little jealous on the point, and seem to think they have a substantial claim to the parentage of the Santillana hero; while even Frenchmen (Voltaire among the number) have been found to take the same view of the case. The most precise and circumstantial charge against Le Sage was made by the Jesuit Father Isla, towards the latter end of last century. He alleged that "Gil Blas" was originally

written in Spanish in 1635, but that, the work having been prohibited by the government, the author fled with a copy of it to France, and that Le Sage, obtaining possession of this copy, translated or adapted his own novel from what he found. The alleged original, however, has never been produced, and it seems doubtful whether it ever existed. Le Sage was unquestionably a good Spanish scholar, for he has avowedly translated several dramas from the language of Cervantes. But it is not likely that a man of his original genius would condescend to the contemptible fraud of publishing as his own what he had in truth derived from another author and another tongue. It will, perhaps, always excite surprise that one who does not appear to have travelled in Spain should have painted the manners of that country with so much liveliness and accuracy. Yet, until some clearer evidence of plagiarism is forthcoming, we should not be justified in robbing a great man of the fame which seems to be his due.

The first and second volumes of "Gil Blas" appeared in 1715, the third in 1724, and the fourth and last in 1735. Its popularity was great, and it has ever since retained one of the highest places in the literature of France. Few works have been more widely read. Translations have been made into nearly all the languages of Europe; and, although there is no figure in the work so universally and familiarly known as Don Quixote or Robinson Crusoe, nor anything so distinctively and strikingly characteristic, the literary reputation of this Franco-Spanish novel is illustrious in all civilised lands, and millions of readers have delighted in its caustic, yet not malignant, satire upon human life and motives. The English version of "Gil Blas" is by Smollett—himself a man of genius, somewhat akin to Le Sage's, though of a coarser fabric; and with admirable spirit has rendered his original. It is pleasant to be able to record that Le Sage was an amiable and a worthy man. He knew the evil that is in the world, but was not depraved by it, nor driven into the practical cynicism of believing that because many persons are bad, all may be so. Of the hero of his most celebrated work, Sir Walter Scott observes that "Gil Blas is naturally disposed towards honesty, though with a mind unfortunately too ductile to resist the temptations of opportunity or example. Generous, good-natured, and humane, he has virtues sufficient to make us love him; and as to respect, it is the last thing he asks at his reader's hands." One of his most prominent characteristics is vanity, which frequently leads him into awkward dilemmas. Inexperience deceives him at the outset of his career; self-love, at a later date. His good education and pleasing manners introduce him to a large round of acquaintances, and there is hardly any class of Spanish society which is not reflected in the sparkling narrative of his adventures. It must be admitted, however, that the portraiture is not morally pleasing. Thieves, cheats, impostors, pretenders, hypocrites, profligates, and dupes, all engaged in intrigues of a more or less questionable order, are the *dramatis personæ* of "Gil Blas." The author's conception of life is not actually base, for the distinctions of right and wrong are not confused by sophisms or by sentimentality; but it is ignoble, because it places out of view all the better elements of human nature—all the devotion, the sacrifice, and the suffering, that this mortal scene discloses. The most objectionable thing in the school of writers to which Le Sage belonged is the absence of any sufficient sense of the high tragedies of life, wherein there is always something deep and sacred. But, as a gallery of society-pictures, full of animation and character, "Gil Blas" will interest and attract successive generations of readers to the remotest time; and the romantic aspects of the old Spanish nationality lend an additional charm to the relation.

This romantic element is more particularly observable in the early chapters of the story, where the hero—then a youth of seventeen—is captured by a band of robbers who dwell in a series of caverns situated in the depths of a wild forest. Here Captain Rolando and his fellow-brigands lead a jovial sort of life, attended by an old negro and an equally ancient serving-woman. The caverns are duly apportioned as distinct sets of apartments, comprising kitchen, dining-room, bed-rooms, and stables, with divers connecting passages, fortified against intrusion by iron grates. It is a little difficult to believe in such a subterranean world, and Le Sage has thought fit to put into the mouth of Captain Rolando an explanation as to how it

came to exist. "This is not a work of our hands," says he, "but was made many years ago; for, after the Moors had got possession of Grenada, Arragon, and almost the whole of Spain, the Christians, rather than submit to the yoke of infidels, fled, and concealed themselves in this country, in Biscay, and in the Asturias. Fugitives, and dispersed in small numbers, they lived in mountains and woods; some lurked in caves, and others contrived many subterranean abodes, of which number this is one." Gil Blas is compelled for a time to serve with the robbers, but he watches for an opportunity, and ultimately escapes, in company with a lady whom the brigands have taken prisoner. It is after this that he figures as a man of the world, according to the Spanish type of two centuries ago.

LESSONS IN ALGEBRA.—II.

DEFINITIONS (continued).

27. When four quantities are *proportional*, the proportion is expressed by points, in the same manner as in the Rule of Proportion in arithmetic. Thus $a : b :: c : d$ signifies that a has to b , the same ratio which c has to d . And $ab : cd :: a + m : b + n$, means that ab is to cd , as the sum of a and m , to the sum of b and n .

28. Algebraic quantities are said to be *like*, when they are expressed by the same letters, and are of the same power; and *unlike*, when the letters are different, or when the same letter is raised to different powers. Thus ab , $3ab$, $-ab$, and $-6ab$, are like quantities, because the letters are the same in each, although the signs and co-efficients are different. But $3a$, $3y$, $3bx$, are unlike quantities, because the letters are unlike, although there is no difference in the signs and co-efficients. So x , xz , and xzx , are unlike quantities, because they are different powers of the same quantity. (They are usually written x , x^2 , and x^3 .) And universally if any quantity is repeated as a factor a number of times in one instance, and a different number of times in another, the products will be *unlike quantities*; thus, cc , ccc , and c , are unlike quantities. But if the same quantity is repeated as a factor the same number of times in each instance, the products are *like quantities*. Thus, aaa , aaa , aaa , and aaa are like quantities.

29. One quantity is said to be a *multiple* of another, when the former contains the latter a certain number of times without a remainder. Thus $10a$ is a multiple of $2a$; and 24 is a multiple of 6 .

30. One quantity is said to be a *measure* of another, when the former is contained in the latter any number of times, without a remainder. Thus $3b$ is a measure of $15b$; and 7 is a measure of 35 .

31. The *value* of an expression, is the number or quantity for which the expression stands. Thus the value of $3 + 4$ is 7 ; that of 3×4 is 12 ; and that of $\frac{16}{8}$ is 2 .

32. The *RECIPROCAL* of a quantity, is the quotient arising from dividing a UNIT by that quantity. The reciprocal of a is $\frac{1}{a}$; the reciprocal of $a + b$ is $\frac{1}{a + b}$; the reciprocal of 4 is $\frac{1}{4}$.

33. In commencing arithmetic the learner has to study the method of expressing words by figures, and, *vice versa*, figures by words; so in algebra he must first accustom himself to convert statements made in words into algebraical expressions, and also to write out algebraical expressions in words. We give two examples, first of all, of the method of converting statements in words into algebraical expressions, and follow them by an exercise to the same. The answers to the examples in this exercise will be found at the end of our next lesson.

EXAMPLES.—What is the algebraic expression for the following statements, in which the letters a , b , c , etc., may be supposed to represent any given quantities?

STATEMENT IN WORDS (1).—The product of a , b , and c , divided by the difference of c and d , is equal to the sum of b and c added to 15 times h .

ALGEBRAICAL EXPRESSION (1). $\frac{abc}{c-d} = b + c + 15h$.

STATEMENT IN WORDS (2).—The sum of a , $2b$, and $3c$ is equal to the difference of d and e divided by 10 times the product of f and g .

ALGEBRAICAL EXPRESSION (2). $a + 2b + 3c = \frac{d-e}{10fg}$

EXERCISE 1.

Give the algebraical expressions for the following statements in words:—

1. The product of the difference of a and h into the sum of b , c , and d , is equal to 37 times m , added to the quotient of b divided by the sum of h and b .
2. The sum of a and b , is to the quotient of b divided by c , as the product of a into c , is to 12 times h .
3. The sum of a , b , and c , divided by six times their product, is equal to four times their sum diminished by d .
4. The quotient of 6 divided by the sum of a and b , is equal to 7 times d , diminished by the quotient of b , divided by 36.

34. We now give an example of the method of writing out algebraical expressions in words.

EXAMPLE.—What will the following expression become, when words are substituted for the signs?

ALGEBRAICAL EXPRESSION. $\frac{a+b}{h} = abc - 6m + \frac{a}{a+c}$

STATEMENT IN WORDS.—The sum of a and b divided by h , is equal to the product of a , b , and c , diminished by 6 times m , and increased by the quotient of a divided by the sum of a and c .

EXERCISE 2.

Write out the following algebraical expressions in words:—

$$1. ab + \frac{3h-c}{x+y} = d \times a + b + c - \frac{h}{6+b}$$

$$2. a + 7(h+x) - \frac{c-6d}{2a+4} = (a+h)(b-c)$$

$$3. a-b : ac :: \frac{d-4}{m} : 3 \times (h+d+y)$$

$$4. \frac{a-h}{3+(b-c)} + \frac{d+ab}{2m} = \frac{ba \times (d+h)}{am} - \frac{cd}{h+d+m}$$

35. At the close of an algebraic process it is often necessary to restore the numbers for which letters have been substituted at the beginning. In doing this the sign $\times$ must not be omitted between the numbers, as it generally is between factors expressed by letters. Thus if a stands for 3, and b for 4, the product ab is not 34, but 3×4 , i.e., 12.

EXAMPLE.—If $a = 1$, $b = 2$, $c = 3$, and $d = 4$ what is the numerical value of the expression $\frac{ad}{b} + c + \frac{bc}{a}$?

Substituting the value given above for each letter, the algebraical expression $\frac{ad}{b} + c + \frac{bc}{a}$ becomes in figures $\frac{1 \times 4}{2} + 3 + \frac{2 \times 3}{1}$ or $\frac{4}{2} + 3 + \frac{6}{1}$ or $2 + 3 + 6$, which is equal to 11.

EXERCISE 3.

Find the values of the following algebraic expressions, supposing $a = 3$; $b = 4$; $c = 2$; $d = 6$; $m = 8$; and $n = 10$:—

$$1. \frac{ad}{c} + a + mn$$

$$2. \frac{b+mn}{cd} + \frac{bc+n}{3d}$$

$$3. \frac{b+ad}{c} + bcm - \frac{b+4cn}{ab}$$

$$4. bm + \frac{ab+3d}{d} - \frac{3bn-d}{3cd}$$

$$5. cbm + \frac{2b}{m-b} + 2n$$

$$6. (a+c) \times (n-m) + \frac{m-b}{m-d} - a$$

$$7. \frac{a \times (d+c)}{n-d} + abc - \frac{(c+b) \times (m-d)}{n-bc}$$

$$8. \frac{ac+5m}{2n+3} + m - cd + \frac{(4d-b) \times (a-c)}{n}$$

POSITIVE AND NEGATIVE QUANTITIES.

36. A *POSITIVE* or *AFFIRMATIVE* quantity is one which is to be added, and has the sign $+$ prefixed to it. (Art. 11.)

37. A *NEGATIVE* quantity is one which is required to be subtracted, and has the sign $-$ prefixed to it. (Art. 10 and 11.)

When several quantities enter into a calculation, it is frequently necessary that some of them should be added together, while others are subtracted.

If, for instance, the profits of trade are the subject of calculation, and the gain is considered positive, the loss will be

negative; because the latter must be subtracted from the former, to determine the clear profit. If the sums of a book account are brought into an algebraic process, the debit and the credit are distinguished by opposite signs.

38. The terms *positive* and *negative*, as used in the mathematics, are merely *relative*. They imply that there is, either in the nature of the quantities, or in their circumstances, or in the purposes which they are to answer in calculation, some such *opposition* as requires that one should be subtracted from the other. But this *opposition* is not that of *existence* and *non-existence*, nor of *one thing greater than nothing*, and *another less than nothing*. For in many cases either of the signs may be, indifferently and at pleasure, applied to the very same quantity; that is, the two characters may change places. In determining the progress of a ship, for instance, her casting may be marked $+$, and her westing $-$; or the westing may be $+$, and the casting $-$. All that is necessary is, that the two signs be prefixed to the quantities, in such a manner as to show which are to be added, and which subtracted. In different processes they may be differently applied. On one occasion, a downward motion may be called positive, and on another occasion negative.

39. In every algebraic calculation, some one of the quantities must be fixed upon to be considered positive. All other quantities which will increase this must be positive also. But those which will tend to diminish it, must be negative. In a mercantile concern, if the stock be supposed to be positive, the profits will be positive; for they increase the stock; they are to be added to it. But the losses will be negative; for they diminish the stock; they are to be subtracted from it.

40. A negative quantity is frequently *greater* than the positive one with which it is connected. But how, it may be asked, can the former be subtracted from the latter? The greater is certainly not contained in the less: how then can it be taken out of it? The answer to this is, that the greater may be supposed first to exhaust the less, and then to leave a remainder equal to the difference between the two. If a man has in his possession 1,000 pounds and has contracted a debt of 1,500; the latter subtracted from the former, not only exhausts the whole of it, but leaves a balance of 500 against him. In common language, he is 500 pounds worse than nothing.

41. In this way, it frequently happens, in the course of an algebraic process, that a negative quantity is brought to stand alone. It has the sign of subtraction, without being connected with any other quantity, from which it is to be subtracted. This denotes that a previous subtraction has left a remainder, which is a part of the quantity subtracted. If the latitude of a ship which is 20 degrees north of the equator is considered positive, and if she sails south 25 degrees: her motion first diminishes her latitude, then reduces it to nothing, and finally gives her 5 degrees of south latitude. The sign $-$ prefixed to the 25 degrees, is retained before the 5, to show that this is what remains of the southward motion, after balancing the 20 degrees of north latitude.

42. A quantity is sometimes said to be *subtracted from 0*. By this is meant, that it belongs to the negative side of 0. But a quantity is said to be *added to 0*, when it belongs to the positive side. Thus, in speaking of the degrees of a thermometer, $0 + 6$ means 6 degrees above 0; and $0 - 6$, 6 degrees below 0.

AXIOMS.

43. An *AXIOM* is a self-evident proposition.

1. If the same quantity or equal quantities be added to equal quantities, their sums will be equal.

2. If the same quantity or equal quantities be subtracted from equal quantities, the remainders will be equal.

3. If equal quantities be multiplied into the same, or equal quantities, the products will be equal.

4. If equal quantities be divided by the same or equal quantities, the quotients will be equal.

5. If the same quantity be both added to and subtracted from another, the value of the latter will not be altered.

6. If a quantity be both multiplied and divided by another, the value of the former will not be altered.

7. Quantities which are respectively equal to any other quantity, are equal to each other.

8. The whole of a quantity is greater than a part.

9. The whole of a quantity is equal to all its parts.

LESSONS IN BOOKKEEPING.—XVIII. THE LEDGER—(continued).

(4) LEDGER. (4)											
Dr. DARLING AND COMPANY. Cr.											
1881. Feb. 26	To Cash	2.	£	s.	d.	1881. Mar. 5	By Cash	3.	£	s.	d.
			50	0	0				50	0	0
Dr. OSMOND AND COMPANY. Cr.											
1881. Jan. 21	To Bills Payable	1.	£	s.	d.	1881. Jan. 7	By Cotton	1.	£	s.	d.
1881. April 18	„ Cash	4.	£	s.	d.	1881. April 4	„ Do.	4.	£	s.	d.
			288	3	4				288	3	4
			183	4	3				183	4	3
			£	471	7				£	471	7
(5) LEDGER. (5)											
Dr. ANDREWS AND COMPANY. Cr.											
1881. Jan. 31	To Bills Payable	1.	£	s.	d.	1881. Mar. 26	By Cotton	1.	£	s.	d.
1881. April 11	„ Do.	4.	£	s.	d.	1881. April 7	„ Do.	4.	£	s.	d.
			463	3	9				463	3	9
			238	17	4				238	17	4
			£	702	1				£	702	1
Dr. BROWN AND SMITH. Cr.											
1881. Feb. 1	To Cotton	2.	£	s.	d.	1881. Mar. 1	By Cash	3.	£	s.	d.
1881. May 27	„ Do.	5.	£	s.	d.	1881. May 27	„ Do.	5.	£	s.	d.
			313	14	5				313	14	5
			97	8	0				97	8	0
			£	411	2				£	411	2
Dr. WHITE AND COMPANY. Cr.											
1881. Mar. 17	To Cash	3.	£	s.	d.	1881. Feb. 17	By Cotton	2.	£	s.	d.
			425	2	7				425	2	7
Dr. WILLIAMS AND COMPANY. Cr.											
1881. Feb. 21	To Cotton	2.	£	s.	d.	1881. Mar. 21	By Cash	3.	£	s.	d.
			360	5	4				360	5	4
(6) LEDGER. (6)											
Dr. EAST INDIA COMPANY. Cr.											
1881. Feb. 28	To Cash	2.	£	s.	d.	1881. Feb. 25	By Cotton	2.	£	s.	d.
1881. April 25	„ Do.	4.	£	s.	d.				£	s.	d.
			60	0	0				721	12	0
			661	12	0				721	12	0
			£	721	12				£	721	12
Dr. JAMES MANNING. Cr.											
1881. Mar. 2	To Cash	3.	£	s.	d.	1881. Feb. 25	By Charges	2.	£	s.	d.
			3	12	2				3	12	2
Dr. SPENCER AND COMPANY. Cr.											
1881. Mar. 13	To Cotton	3.	£	s.	d.	1881. April 13	By Cash	4.	£	s.	d.
			160	13	7				160	13	7
Dr. THOMPSON AND COMPANY. Cr.											
1881. Mar. 16	To Cotton	3.	£	s.	d.	1881. Mar. 16	By Cash	3.	£	s.	d.
			257	12	1				257	12	1
(7) LEDGER. (7)											
Dr. ALTHORPE AND COMPANY. Cr.											
1881. Mar. 22	To Cotton	3.	£	s.	d.	1881. Mar. 29	By Cash	3.	£	s.	d.
			141	6	8				141	6	8

(7) BARING, SMITH, AND COMPANY. (7)											
Dr. Cr.											
1881. Mar. 31	To Bills Payable	3.	£	s.	d.	1881. Mar. 24	By Cotton	3.	£	s.	d.
			288	1	3				288	1	3
Dr. ALLISON AND COMPANY. Cr.											
1881. April 12	To Cotton	4.	£	s.	d.	1881. April 13	By Bills Receivable	4.	£	s.	d.
			150	0	6				150	0	6
Dr. THOMAS JONES. Cr.											
1881. April 30	To Cotton	4.	£	s.	d.	1881. April 26	By Bills Receivable	4.	£	s.	d.
1881. May 4	„ „	5.	£	s.	d.	1881. May 14	„ Do.	5.	£	s.	d.
			776	13	0				226	11	4
			241	5	2				791	6	10
			£	1017	18				£	1017	18
(8) LEDGER. (8)											
Dr. LLOYD AND COMPANY. Cr.											
1881. April 20	To Cotton	4.	£	s.	d.	1881. April 25	By Bills Receivable	4.	£	s.	d.
1881. May 2	„ Do.	5.	£	s.	d.	1881. May 9	„ Do.	5.	£	s.	d.
			223	9	10				223	9	10
			217	18	10				217	18	10
			£	441	8				£	441	8
Dr. OVINGTON AND COMPANY. Cr.											
1881. April 29	To Bills Payable	4.	£	s.	d.	1881. April 22	By Cotton	4.	£	s.	d.
			245	8	0				245	8	0
Dr. POWELL AND COMPANY. Cr.											
1881. May 5	To Cotton	5.	£	s.	d.	1881. May 15	By Bills Receivable	5.	£	s.	d.
1881. June 1	„ Do.	6.	£	s.	d.	1881. June 11	„ Do.	6.	£	s.	d.
			299	17	2				299	17	2
			308	5	0				308	5	0
			£	608	2				£	608	2
Dr. PERKINS AND COMPANY. Cr.											
1881. May 25	To Cash	5.	£	s.	d.	1881. May 31	By Bills Receivable	5.	£	s.	d.
1881. „ 16	„ Charges	5.	£	s.	d.	1881. June 30	„ Balance Account	7.	£	s.	d.
			823	6	0				823	6	0
			21	5	10				21	5	10
			£	844	11				£	844	11
(9) LEDGER. (9)											
Dr. BALANCE ACCOUNT. Cr.											
1881. June 30	To Sundries	7.	£	s.	d.	1881. June 30	By Sundries	7.	£	s.	d.
			2654	17	10				2654	17	10
Dr. PROFIT AND LOSS ACCOUNT. Cr.											
1881. June 30	To Sundries	7.	£	s.	d.	1881. June 30	By Sundries	7.	£	s.	d.
1881. „ „	„ Stock Account	„	£	s.	d.				£	s.	d.
			40	17	4				782	8	7
			741	11	3				782	8	7
			£	782	8				£	782	8
TRIAL BALANCE. Dr. Cr.											
	Stock Account	1.	£	s.	d.		£	s.	d.		
	Private Account	„	59	0	0		1200	0	0		
	Cash	2.	9976	0	7		9973	6	4		
	Petty Cash	„	60	0	0		57	8	9		
	Bills Receivable	„	3040	15	6		2732	10	6		
	Bills Payable	„	751	7	1		1523	13	8		
	Three per Cents.	3.	985	0	0		997	10	0		
	Cotton	„	2853	12	6		3548	9	7		
	London and Westminster Bank	„	5910	0	0		3665	0	0		
	Interest	4.	1	2	3						
	Charges	„	61	0	11		21	5	10		
	Perkins and Co.	8.	844	11	10		823	6	0		
			£	24542	10		£	24542	10		

LESSONS IN MUSIC.—XIV.

CONSONANCES OF NOTES.

In addition to the observations on the consonances of DOH, ME, SOH in a former lesson, let the following remarks be examined and tested.

FAH forms a more "perfect" consonance with the key-note than LAH. (It is more like it, and has a greater number of coinciding vibrations.) But the consonance of LAH with the key-note is more soft and pleasing.

The best consonances with FAH are RAY and LAH. The best notes to sound with LAH are FAH and DOH.

It may be noticed that when the notes of a consonance are in their closest position, as DOH¹ with LAH, or LAH with FAH, the proper mental effect of each is sweetly blended with that of the other; but when, by raising or lowering one of them an octave, they are more distant, as DOH with LAH or LAH¹ with FAH, each produces its own effect with greater distinctness, though still with good agreement.

Two persons can easily try these experiments by singing the chord DOH, ME, SOH together, and then "striking out" each into the separate note previously agreed on. It would be difficult to contrive any better preparation for the study of harmony.

EXERCISE 22.—THE NORWICH CHANT. KEY C. M. 66.

The | grass' withereth th' || flower fadeth
BUT THE | WORD OF OUR || GOD · SHALL | STAND · FOR | EVER.

The effect of LAH is beautifully shown in the air, and that of FAH in the second. Look back for the instructions on chanting given in Lesson II. (Vol. I., page 90).

EXERCISE 23.—WHITE SAND AND GREY SAND. KEY C. M. 50.

(A Round for Three Voices.)

This illustrates FAH and LAH when in succession at the close. If three persons can be got to join in singing it let the first sing alone till he comes to the note over which an asterisk is placed to the words "Who'll." Then just as he strikes that note let the second singer strike the first note and

follow. When he reaches the asterisk let the third voice strike in. When each singer reaches the close, let him begin again instantly; and so let them go on, round and round, after one another, until the leader makes a signal for all to stop together. This kind of composition is called a round.

EXERCISE 24.—IF HAPPINESS. KEY D. M. 60.

(A Round for Four Voices.)

In singing this round take care to keep the time accurately. Here four voices should follow each other just as three voices did in the last case. FAH is well illustrated here. If you sing the round with four voices, or even with only two, you will have an opportunity of comparing the consonance, FAH with LAH, with the semi-dissonance FAH with TE. Directly the second voice gets on to the bar containing LAH, LAH, TE, TE, the first

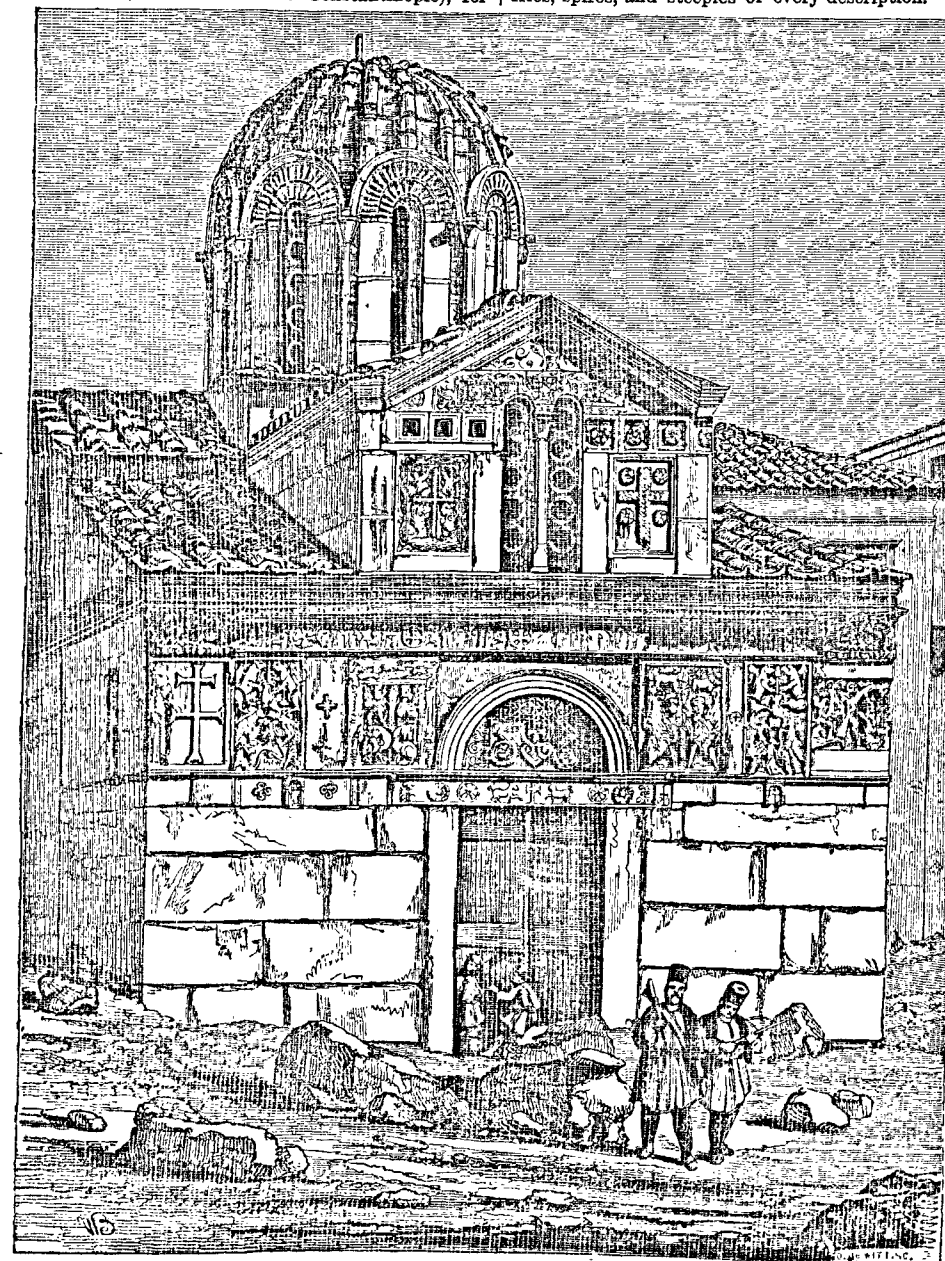
voice will be singing FAH, FAH, FAH, FAH. "TE with FAH" is usually treated as a dissonance; but it will be found that on occasions it is a very piquant and useful one. Notice particularly whether your own taste and ear do not require, what musicians always demand, that it should be followed by the consonance "ME with DOH," the FAH descending on ME, and the TE ascending to DOH.

LESSONS IN ARCHITECTURE.—XI.

ARCADES—CUPOLAS—DOMES—CHURCHES—BASILICAS—
ROMANESQUE STYLE—ARABIC ARCH, ETC.

THE Byzantines, the successors to the arts of the Romans, in consequence of the transference of the seat of the empire from Rome to Byzantium (afterwards called Constantinople), fol-

Romans, was very common at the period above mentioned. The pendentives, or portions of the vaults suspended out of the perpendicular of the walls—that is, the portions between the arches and the dome—were of Byzantine invention, and formed a new and bold application of the arch in building, of which they soon began to make an improper use in the erection of towers, belfries, spires, and steeples of every description. An example of

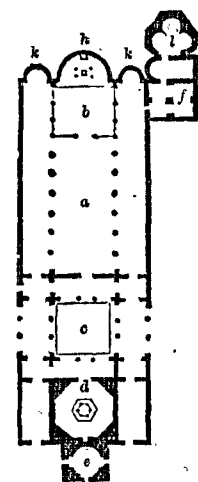


THE CATHOLICON AT ATHENS.

lowed their arched system of architecture, and even extended it to such a degree in their edifices that the architrave, which their predecessors had hitherto preserved in the construction of their temples, was at last almost entirely abandoned. The Byzantine architects not only used the arcade as the connecting link from column to column in their erections, but they surmounted their churches with cupolas or domes of an immense size. This kind of vault, which had been seldom used by the

this application of the arch and vault will be seen in the annexed illustration of the Catholicicon at Athens. The first Christians of the West, in their adoption of the style of architecture which we have called the Latin style, substituted the arcade for the architrave; but possessing less skill as builders than those of the East, their innovations terminated at this point. The great basilicas—that is, the palatial or royal churches of the West—were edifices covered with plain woodwork, and had only

vaulted roofs or domes at the extreme or lower end above the chancel, and sometimes also above the aisles. They had commonly in front the accessory buildings, including the baptistery and the rooms for the catechumens, or those who were preparing for admission into the church. These adjoining erections were then separated from the church by an atrium or hall, surrounded by columns which led from outside to the door of the church, which always had a porch, or *narthex*, as it was called. In the interior, two rows of columns divided the edifice into the nave and the aisles. The nave alone in the basilicas or churches of the primitive Christians, terminated in a semicircular arch or choir. At a later period the aisles had also their choirs; it was then that the first story or gallery which was erected upon the aisles disappeared, and the women, for whom it was reserved, began to occupy the left side of the building. The different parts of the Basilica of Parenzo will convey to the mind of the reader the arrangement of the principal parts of the churches now described.



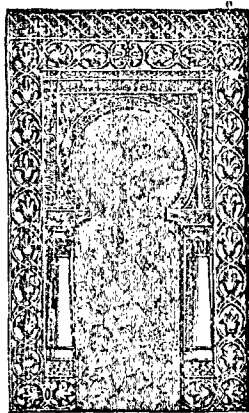
PLAN OF THE BASILICA OF PARENZO.

- a. The principal nave. b. The chancel. c. The hall, or atrium. d. The baptistery. e. The steeple, or bell-fry. f. The sacristy, or vestry. g. The choir. h. The small choirs. i. The triclinium, or supper-room.

Orientation, or building churches east and west, became the decided rule; a transverse nave, or transept, changed the arrangement of the interior of churches, and gave them the form of a cross. The choir or recess, of a semicircular form, was commonly unique, and spanned the whole width of the edifice, including the nave and the aisles. Some Romanesque churches, however, have preserved the three recesses or choirs; and these are generally the oldest. The columns were replaced by square piers, ornamented on each side by a column carrying groined arches; and when stone mouldings were introduced at the edges of the domes, the number of the columns was increased to eight. The shafts of the four intermediate columns were then proportionally lengthened, and departing from the proportions established by antiquity, lost their rational proportion to their diameter; the choir alone preserved the isolated columns. Independently of the principal altar, secondary ones were erected, of which the number was afterwards augmented by those of the chapels built round the choir. The exterior of the Romanesque churches also presented a very different aspect from that of the basilicas. The belfries, which were at first small, became then of great importance, and were raised above the porch, or above the cross aisle. These constructions were very solid, and had several storeys, partially open, except at top; and were surmounted by lofty stone spires. At a later period, the abutments, or spur-walls, became insufficient to sustain the thrust of the great domes, and were then detached from the walls and transformed into buttresses. Specimens of this kind of edifice may be seen in the church of Rosheim, in the Department of the Lower Rhine; St. Germain-des-Prés, at Paris; of *L'Aye-aux-Hommes*, at Caen; of Bocheville, near Rouen; and others in France. In the most of these churches, there is a small gallery over the aisle, like that of St. Germain-des-Prés at Paris,

which represents the gallery of the early basilicas. The columns or pillars are united by circular arches, ornamented by archivolts in simple profile, and the whole of the edifice is covered with groined vaulting, and with stone mouldings of the same description.

At the commencement of the Romanesque period in the West, the Eastern style of art, the parent of so many architectural novelties, was developed anew in Asia and Africa, and the Arabs, who played so prominent a part in the history of this epoch, covered Arabia and Egypt, and penetrated the interior of Persia, with their edifices. The Moorish branch extended along the northern side of Africa to the ocean, and there all that an Eastern imagination could produce that was fantastical and marvellous, was reproduced in their architectural works. During the most ancient period of this art the semicircular arch predominated; but it soon overstepped its central point, and the arch becoming more than a semicircle, took the shape nearly of a horse-shoe. At a later period, the intrados, or inner ring of the arch, was carved in the manner exhibited in the celebrated Mosque of Cordova. The second period was that of the pointed arch very ancient specimens of which are found at Cairo. These monuments or erections are purely Arabic, such as the Mekias or Nilometer, and various mosques of that city. In Persia and in India the same style is exhibited, and is always found in connection with the pointed arch, and the same principles are followed in the architecture of that country at the present day. We give in the annexed engraving a specimen of the Arabic arch. An important question has never yet been answered respecting the origin of the pointed arch, which was first, as we have seen, used by the Pelasgians, but which, abandoned until the Middle Ages, was again taken up by the Arabian and the Western architects, at an epoch when it is difficult to ascertain whether the East preceded the West in its application, or whether the reverse was the case. Whichever was the case was of little moment, until it was extended as a complete system of construction, and became the foundation of the Gothic or ogival style of architecture. It appeared in the West, in the twelfth century, in several rare edifices, in which it usually occupied the lower part of the building, as presenting more resistance in supporting its elevated portions. From this use, first originating in the demand for solidity, it was extended to all parts of the building. Thus applied, this new system of architecture was developed, took its flight, and the thirteenth, fourteenth, and fifteenth centuries saw its rise, its full vigour, and its decay. The Gothic churches are in general larger than those of the Romanesque period, they are disposed in the same way, but their architecture becomes softer, and the forms more graceful.



SPECIMEN OF THE ARABIC OR MOORISH ARCH.

LESSONS IN ARITHMETIC.—XXXVIII.

EQUATION OF PAYMENTS.

18. This is a method by which to find the time at which two or more debts, due at different times, may be equitably paid by one payment, equal to the sum of the amounts of the debts. This time is called the *equated time* of payment. We will first take the case of two sums.

The principle upon which the time is calculated is this—that the sum of the present values of the two debts is equal to the present value of the sum of the amounts of the debts supposed due at the equated time.

Thus, if £100 were due nine months hence, and £50 twelve months hence, at 4 per cent., we must find the present value of each, and add them together. We must then find the time in which, at the given rate of interest, the sum so formed would amount to £150.

EXAMPLE.—Find the equated time of payment of £309, due

nine months hence, and of £416, due twelve months hence, at 4 per cent.

1. Reckoning True Discount.

Present value of £309, due 9 months hence, is . . . £300
Present value of £416, due 12 months hence, is . . . £400

The interest of £300 for 9 months is the same as that of £2,700 for 1 month.

The interest of £400 for 12 months is the same as that of £4,800 for 1 month.

Hence the interest on £700 (the sum of the present values) for the equated time must be equal to the interest on £2,700 + £4,800, or £7,500, for one month. Now the time in which the same interest will be produced by two different sums will be inversely proportional to the sums; hence the equated time will be $\frac{7500}{300} \div 10$ months;

$$\text{Noticing that } \frac{7500}{300} = \frac{(9 \times 300) + (12 \times 400)}{300 + 400}.$$

we see the truth of the following

Rule for finding the Equated Time of two or more Debts due at different times, at a given rate per cent., True Discount being reckoned.

Find the true present value of each debt, multiply it by its corresponding time, and add the products. Divide the sum of the products by the sum of the present values.

2. Reckoning Mercantile Discount.

Interest of £309 for 9 months is the same as that of $9 \times £309$, or £2,781, for 1 month.

That on £416 for 12 months is the same as that of $12 \times £416$, or £4,992, for 1 month.

Hence the interest on £309 + £416, or £725, for the equated time must be the same as that on £2,781 + £4,992, or £7,773, for one month.

Hence the equated time is $\frac{7773}{725}$, or 10.72 months nearly.

We get, then, the following

Rule for finding the Equated Time of two or more Debts due at different times, Mercantile Discount being reckoned:

Multiply the amount of each debt by its corresponding time, and add the products. Divide the sum of the products by the sum of the debts.

N.B.—When mercantile discount is reckoned (as is the case in practice), the rate per cent. does not affect the calculation.

The times of both debts must of course be expressed in the same denomination, and the result will appear in that denomination.

EXERCISE 58.—EQUATION OF PAYMENTS.

1. Find the equated time of £309, payable in 3 years, and of £1,200, payable in 4 years, at 5 per cent. simple interest, by reckoning (1) true, (2) mercantile discount.

2. Find the equated time of payment of £261 5s., due 6 months hence, and of £209, due 18 months hence, at $\frac{1}{2}$ per cent., reckoning (1) true, (2) mercantile discount.

3. Find the equated time of £692, payable in 60 days, and £254, payable in 90 days.

4. I owe £500, due 50 days hence, and £750, due 100 days hence; when should I liquidate the debt equitably by paying down £1,500, interest being reckoned at 4 per cent. per annum?

STOCKS, SHARES, BROKERAGE, INSURANCE, ETC.

19. Suppose that I lend a sum of money to the Government or to a company, on the understanding that I am to receive a certain fixed annual per-centage upon it (say 3 per cent.), and that at any time after this transaction it is found that more than 3 per cent. can be commonly got for money; it is clear that if I sell then my claim upon the Government or company to another person, he will not give me so much as I gave. The name given to money so lent is *Stock*, and the price given at any time for £100 of this stock is the price of stock at that time.

The Funds are properly the money raised by the Government, by taxes, etc., to pay the interest of the debt, but the term is often applied to the debt itself. Thus, when we hear that the Funds are at 90 it means that £90 5s. must be paid for £100 worth of stock, this entitling the purchaser to receive from the Government the sum of £3 (in the Three per Cents.) agreed to be paid upon the £100 originally lent.

Different names are given to different descriptions of stock, according to the original conditions of the formation of the debt. For instance, the Three per Cent. Consols—i.e., the Three per Cent. Consolidated Annuities, etc.

20. Given the price of Stock, to find the actual Rate per Cent. received.

EXAMPLE.—If the Three per Cents. are at 93 $\frac{1}{2}$, find the rate per cent. of interest received.

For £93 5s. paid, £3 is received yearly.

Hence, as $93\frac{1}{2} : 3 :: 100 : \text{rate per cent. received.}$

Therefore $\frac{300}{93\frac{1}{2}} = 3.217$, the rate per cent.

21. Given the sum invested, and the price of the Stock, to find the Income.

EXAMPLE.—If £1,200 be invested in the Three per Cents when they are at 88 $\frac{1}{2}$, find the income.

Since for every £88 $\frac{1}{2}$ paid, £100 worth of stock is received, every £88 $\frac{1}{2}$ paid will produce an annual income of £3.

Hence, as $88\frac{1}{2} : £3 :: £1,200 : \text{required income.}$

Therefore the required income = $\frac{3600}{88\frac{1}{2}} = \frac{1920}{47} = £40 \text{ 17s. } 0\frac{1}{2}\text{d.}$

22. Given the income received from an investment of a given Sum of Money, to find the price of the Stock.

EXAMPLE.—If £1,200 invested in the Three per Cents. produces a yearly income of £40 17s. $0\frac{1}{2}\text{d.}$, find the price of the stock.

£40 17s. $0\frac{1}{2}\text{d.}$ is $\frac{2}{25}$ of a pound.

Hence $\frac{1}{25} \times \frac{1000}{1} = 40$ is the number of times £3 is contained in the income; that is, it is the number of times £100 is contained in the amount of stock bought.

Hence, £1,200 divided by this will give the actual money paid for each £100 of stock.

Therefore the required price = $\frac{3 \times 47}{1000} \times 1,200 = \frac{174}{1000} = £88\frac{1}{2}$.

23. When Government stock is purchased, the transaction is effected through the agency of a broker, who charges $\frac{1}{4}$ th per cent. upon the stock bought—i.e., 2s. 6d. upon every £100 of stock purchased.

Thus, if £500 worth of stock be purchased when the funds are at 92, the actual price paid will be $(5 \times £92) + (5 \times £\frac{1}{4})$, or £460 12s. 6d. And, similarly, the seller of stock pays his broker $\frac{1}{4}$ th per cent. upon the amount of stock sold for him. This charge is called *Brokerage*, or *Commission*. In the examples we give, however, it need not be reckoned unless it is expressly mentioned.

24. Exactly the same principles hold with reference to *Shares* of any kind. Originally they are fixed at a certain price, and then, according to the success or failure of the company, and the probable amount of dividend it will pay, etc., the value of the shares fluctuates.

When a share, or £100 of stock, will sell for the original price which was paid for it, then the shares are said to be at *par*. When the price is less by a certain amount than the original price, they are said to be at so much *discount*; and when the price is more by a certain amount, they are said to be at so much *premium*.

25. EXAMPLE.—The income derived from investing a sum in the Three per Cents. at 90 differs by £1 from that derived from an equal sum invested in railway shares at 140, paying 5 per cent. upon the original shares. Find the sum.

In the first investment,

£90 produces annually £3;

Therefore £1 " " £ $\frac{10}{9}$, or £1 $\frac{1}{9}$.

In the second investment,

£140 produces annually £5;

Therefore £1 " " £ $\frac{100}{14}$, or £7 $\frac{1}{7}$.

Hence the difference of income produced by £1 is $\frac{1}{9} - \frac{1}{14}$, or £ $\frac{1}{126}$.

Hence the difference of income produced by £420 is £4 $\frac{1}{3}$, or £4.

The answer is therefore £420.

INSURANCE.

26. By the yearly payment of a certain sum called a *Premium* to an insurance company, a person can secure at his death the payment of a certain larger sum. The document by which the company binds itself to pay over the money at the death of the insurer is called the *Policy of Insurance*. Thus, a man of 30, in ordinary health, by paying about £25 a year to a company, is able to "insure his life" for £1,000.

The principles which determine the amount of premium to be paid depend upon carefully prepared tables of statistics, showing the average rate of mortality at different ages, and also upon the doctrine of chances and annuities, but they are too complicated to be introduced here.

There are various other kinds of insurance, as, for instance,

insurance against loss by accidental fire, where a man pays a certain per-centage upon the value of the property insured.

Farmers can insure their crops against damage by storms. Owners of vessels can insure them and their cargoes, etc.

EXERCISE 59.—EXAMPLES IN STOCKS, SHARES, INSURANCE, ETC.

1. When the Three per Cents. are at 89, find the rate per cent. received.
2. When the Three and a Half per Cents. are at 92, find the rate per cent. received.
3. When the Four per Cents. are at 96, find the rate per cent. received.
4. Three per Cents. are offered at 90½, Five per Cents. at 150½; in which should one invest?
5. Shares paying an interest of £1 0s. 6d. cost 22½; what is the rate per cent. received? What is the rate per cent. received after a deduction of income tax of 7d. in the pound?
6. Is it better to invest in the Three per Cents. at 89½ or the Three and a Half per Cents. at 98½?
7. When the Three per Cents. are at 86, find what the Three and a Half per Cents. should be at, so that an investment in both should produce the same income.
8. Find the income derived from investing £2,500 in the Three per Cents. at 86.
9. Find the income derived from investing £1,000 in the Three per Cents. at 87½, after deducting an income tax of 7d. in the pound.
10. What must a person have invested in the Three per Cents. at 90½, if a transfer of ½ of his capital to the Four per Cents. at 115 would increase his income by £7?
11. A person invests £5,187 10s. in the Three per Cents. at 83, and when the funds have risen to 85 he transfers two-fifths of his capital to the Four per Cents. at 96; find the alteration in his income.
12. A person sells out of the Three and a Half per Cents. at 92½, and realises £18,550; if he invests two-fifths of the produce in the Four per Cents. at 96, and the remainder in the Three per Cents. at 90, find the alteration in his income. Find also the alteration in the per-centage he gets.
13. What is the price of the Three per Cents. when £10,000 will purchase £11,111 2s. 2½d. worth of stock? What will be the annual income produced?
14. When the Three per Cents. are at 87½, what must the Three and a Quarter per Cents. be at in order that an investment of £1,580 in the latter may produce an income greater than the same sum invested in the former by £1 18s. 6½d.?
15. A person buys £500 worth of stock at 98½; what must he sell at to gain £21 5s. by the transaction?
16. Which is the better investment, bank stock paying 10 per cent. at 319, or Three per Cent. Consols at 96?
17. A man invests £4,297 10s. in the Three per Cents. at 95½; he sells out one-third of his stock when the funds have fallen to 94, £1,600 worth of stock when they have risen to 96½, and the remainder at par. What does he gain?
18. The income derived from a sum invested in the Three per Cents. at 90½ differs from that derived from an equal sum in the Five per Cents. at 150½ by £1. Find the sum.
19. A person finds that if he invest a certain sum in railway shares paying £6 a share when the £100 share is at 132, he will obtain £10 16s. a year more for his money than if he invest in the Three per Cent. Consols at 93. What sum has he to invest?
20. A person invests £10,000 in the Three per Cents. at 92½, and sells out two-thirds when they have risen 1 per cent. above, and the remainder when they have fallen 1 per cent. below, the price at which he bought; he then invests the proceeds in the Four per Cents. at par. Find the change in his income.
21. The net income of an estate, after deducting 10d. in the pound for income tax and 4 per cent. on the remainder for expenses of collection, is £437. What is the gross rental?

KEY TO EXERCISE IN LESSON XXXVII. (page 47).

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|--------------------|-------------------------|--------------------------|
| 1. £21. | 8. £21 8s. 11½d. | 14. 238 18s. 7½d. ½ft. |
| 2. £16 4s. 8½d. | 9. Ratio is 200 : 209— | 15. £987 13s. 5½d. |
| 3. £32½. | £109 6s. 8d. | 16. £1,236 5s. 5½d. ½ft. |
| 4. £436 17s. 10½d. | 10. £293 13s. 4d. | 17. £832 4s. 6½d. |
| 5. 833 10s. 10½d. | 11. In 1 year 5½ mths. | 18. £310 6s. 4½d. |
| 6. £798 4s. 11½d. | 12. 3½ per cent. | 19. £752 16s. 1½d. |
| 7. £8½. | 13. £230 7s. 10½d. ½ft. | 20. £535 5s. 5½d. |

LESSONS IN FRENCH.—XLII.

SECTION XCIII.—SOME PECULIAR IDIOMS.

1. *Se démettre* [4. ir.] le bras, le poignet, corresponds to the English expression to *dislocate one's arm, wrist, to put one's arm out of joint*. In this sense *se démettre* takes no preposition before its object, the reflexive pronoun being a dative:—

Je me suis démis l'épaule. I have dislocated my shoulder.

2. *Se démettre*, used in the sense of *to resign, to give up*, takes the preposition *de* before its object:—

Il s'est démis de sa place. He has resigned his place.

3. *S'emparer, to seize, to lay hold of*, takes *de* before its object:—

Il s'est emparé de ce chapeau. He seized upon that hat.

4. *S'empêcher, to prevent one's self, to forbear, to help*, takes *de* before another verb:—

Je ne puis m'empêcher de rire. I cannot help laughing.
Je ne puis m'en empêcher. I cannot help doing so.

5. *S'inquiéter* answers to the English expression *to be or become uneasy, to trouble one's self*; it takes *de* before its object, be this object noun, pronoun, or verb:—

Je ne m'inquiète pas de cela. I am not uneasy about that.

6. *Se comporter* answers to the expressions *to behave, to deport one's self*.

7. *S'attendre* means *to await, to expect*. It takes *à* before its object:—

Je ne m'attendais pas à cela. I did not expect that.
Je ne m'y attendais pas. I did not expect it.

MISCELLANEOUS EXAMPLES.

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|---|--|
| Vous êtes-vous démis l'épaule? | Have you dislocated your shoulder? |
| Je me la suis démise [Sect. 45, 2, § 130]. | I dislocated it. |
| Cette demoiselle s'est démise le poignet. | That young lady dislocated her wrist. |
| Qui le lui a remis? | Who set it for her? |
| Le Dr. L. a remis l'épaule à ma sœur. | Dr. L. set my sister's shoulder. |
| Vous êtes-vous démis de votre place? | Have you resigned your situation? |
| Je m'en suis démis [§ 131, 11]. | I have resigned it. |
| Nous ne pouvions nous empêcher de sourire pendant ce récit. | We could not help smiling during that narration. |
| Vous êtes-vous emparé de ce livre? | Have you seized that book? |
| Je m'en suis emparé. | I laid hold of it. |
| De quoi vous inquiétez-vous? | What do you trouble yourself about? |
| Je ne m'inquiète de rien. | I trouble myself about nothing. |
| Comment ce jeune homme se comporte-t-il? | How does that young man behave? |
| Il se comporte comme il faut. | He behaves properly. |
| Je ne m'attendais pas à une telle réponse. | I did not expect such an answer. |
| Je ne m'y attendais nullement. | I did not expect it by any means. |

EXERCISE 181.

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|-------------------------|------------------------------|---------------------------|
| À l'avenir, in future. | Gauche, left. | Part, f. part. |
| Bras, m. arm. | Mieux, better. | Paysan, m. peasant. |
| Casser, 1. to break. | Monde (tout le), every-body. | Prusse, f. Prussia. |
| Droit, e, right. | | Séjour, m. stay. |
| Durant, during. | Obligé, obliged. | Traitement, m. treatment. |
| Écritoire, f. inkstand. | Pareil, le, similar, such. | Ville, f. city. |
| Ennemi, m. enemy. | | |

1. Ne vous étiez-vous pas démis le bras? 2. Je ne me l'étais pas démis; je me l'étais cassé. 3. Si vous alliez en Amérique, vous démettriez-vous de votre place? 4. Je serais obligé de m'en démettre. 5. Y a-t-il longtemps que votre cousin s'est démis de la sienne? 6. Il y a un mois qu'il s'en est démis. 7. L'ennemi s'est-il emparé de la ville? 8. Il s'en est emparé. 9. Votre fils se comportera-t-il mieux à l'avenir? 10. Il s'est très bien comporté durant son séjour en Prusse. 11. Vous attendiez-vous à un pareil traitement de sa part? 12. Je ne m'y attendais pas. 13. À quoi vous attendiez-vous? 14. Je m'attendais à être traité comme il faut. 15. Pourquoi vous êtes-vous moqué de lui? 16. Parce que je n'ai pu m'en empêcher. 17. Si vous laissiez votre écritoire ici, le paysan s'en emparerait-il? 18. Il s'en emparerait certainement. 19. Votre associé se comporte-t-il bien envers vous? 20. Il se comporte bien envers tout le monde. 21. Qui a remis le poignet à votre sœur? 22. Le Dr. G. le lui a remis. 23. M. votre père ne s'est-il pas démis le bras droit ce matin? 24. Il ne se l'est pas démis; il se l'est cassé ce matin à cinq heures.

EXERCISE 182.

1. Has not Dr. L. resigned his place? 2. He has not resigned it. 3. He would resign it if he went to Germany. 4. Are you obliged to resign your place? 5. I am not obliged to resign it. 6. Has your cousin dislocated his arm? 7. He has not dislocated his arm, but his shoulder. 8. Who set it for him? 9. Doctor F. set it for him. 10. Has not your mother dislocated her wrist? 11. She has not dislocated her wrist; she has broken her arm. 12. Has the enemy seized the town? 13. The enemy has seized the town. 14. Will not some one lay hold of your hat, if you leave it here? 15. Some one will lay hold of it. 16. How has your son behaved this morning? 17. He behaved very well. 18. He always behaves properly. 19. Do you not trouble yourself uselessly (inutilement)? 20. I do not trouble myself at all (du tout). 21. Did you expect such treatment from (de la part de) your son? 22. I did not expect such treatment from him (de sa part). 23. Does that young lady behave well towards her mother? 24. She behaves well towards everybody. 25. Will you behave better in future? 26. We will behave well. 27. Have you broken your finger (doigt)? 28. I have broken my thumb (pouce). 29. Could you help going to sleep (de dormir)? 30. We could not help smiling. 31. My sisters could not help laughing. 32. Why are you uneasy? 33. Because (parce que) my son does not behave well. 34. Did your father expect to be well treated? 35. He expected to be treated properly.

SECTION XCIV.

1. *N'importe*, an ellipsis of *il n'importe*, answers to the English expression "*no matter*," it does not matter, never mind:—
Donnez-moi un livre, n'importe. Give me a book, no matter which. lequel.
2. *Qu'importe?* answers to the English phrase *what matter?* What does it matter? When the expression is followed by a plural subject, the verb *importer* is put in the plural:—
Que nous importent leurs murmures? What do we care for their murmurs? murmures?
3. *N'est-ce pas?* corresponds to the English expressions, *is it not?* *is he not?* *do they not?* following an assertion:—
Il fait froid; n'est-ce pas? It is cold; is it not?
N'est-ce pas que votre frère est arrivé? Your brother is come, is he not? arrived?
4. *N'est-ce pas?* frequently precedes the assertion, and is then followed by *que*:—
N'est-ce pas que votre frère est arrivé? Your brother is come, is he not? arrived?
5. *Regarder, to look at*, is used in the sense of *to concern*:—
Cela regarde votre frère. That concerns your brother.
6. *En vouloir* (3. ir.) à quelqu'un, à quelque chose, means *to have a design against or upon; a grudge against any one: to be angry with any one on account of something*:—
Il en veut à notre vie. He has a design against our life.

MISCELLANEOUS EXAMPLES.

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|--|--|
| Pourvu que vous veniez, n'importe par quel chemin. | Provided you come, no matter which way. |
| Pourvu qu'il le fasse, n'importe comment. | Provided he does it, no matter how. |
| Apportez-moi quelque chose, n'importe quel. | Bring me something, no matter what. |
| J'en mourrai; n'importe. | I shall die through it; no matter. |
| Il n'est pas satisfait; qu'importe? | He is not satisfied with it; what matters it? |
| Il refuse nos présents; qu'importe? | He refuses our presents; what does it matter? |
| Que nous importe cette affaire? | What do we care for that affair? |
| Que vous importe son arrivée? | What is his arrival to us? |
| Vous viendrez; n'est-ce pas? | You will come; will you not? |
| N'est-ce pas que vous viendrez? | Does that concern me? Is that anything to me? |
| Est-ce que cela me regarde? | That concerns nobody. That is nobody's business. |
| Cela ne regarde personne. | He has a design upon our property. |
| Il en veut à nos biens. | He has a grudge against our friends. |
| Il en veut à nos amis. | Is that your business? |
| Cela vous regarde-t-il? | |

EXERCISE 183.

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|----------------------------|-----------------------------------|-------------------------------|
| Accord-er, 1. to grant. | Hasard, m. chance. | Pour-oir, 3. ir. to be able. |
| Approuv-er, 1. to approve. | Loin, far. | |
| Auteur, m. author. | Moquer (se), 1. ref. to laugh at. | Sang, m. blood. |
| Bien, very. | Murmure, m. murmur. | Va, from aller, to go. |
| Condamn-er, 1. to condemn. | Peu, little. | Velours, m. velvet. |
| | Plainte, f. complaint. | Vers-er, 1. to pour, to shed. |
| | | Vil, e, vile. |
1. Que vous apporterai-je de Londres? 2. Apportez-nous ce que vous pourrez, n'importe quoi. 3. Lui avez-vous dit d'apporter du velours? 4. Je lui ai dit d'en apporter, n'importe de quelle qualité. 5. Pourvu que quelqu'un vienne, n'importe qui. 6. Que m'importe qu'Arnaud m'approuve ou me condamne? (BOILEAU.) 7. Vous accordez-t-il votre demande? 8. Il refuse; qu'importe? 9. Est-il satisfait des efforts que vous avez faits? 10. Il n'en est pas satisfait; qu'importe? 11. Il n'a pas voulu nous recevoir; peu m'importe. 12. Qu'importent les plaintes et les murmures des auteurs, si le public s'en moque? (FÉRAUD.) 13. Qu'importe qu'un hasard ou un sang vil soit versé? (RACINE.) 14. Cela vous regarde; n'est-ce pas? 15. Cela ne me regarde pas. 16. Cela ne regarde que moi. 17. Vous leur avez dit que ces affaires ne les regardaient pas; n'est-ce pas? 18. Vous m'en voulez; n'est-ce pas?—N'importe. 19. À qui en voulez-vous? 20. Nous n'en voulons à personne. 21. Nous ne vous en voulons pas. 22. Vous m'en voudrez; n'est-ce pas? 23. En voulez-vous à la vie de votre ami? 24. Je n'en veux pas à sa vie.

EXERCISE 184.

1. Which way will your brother come? 2. Provided he comes to-morrow, it does not matter which way. 3. Will he write to your brother? 4. He will not write to him; but it is no matter. 5. Will you not lend me a book? 6. Which book do you wish to have? 7. No matter which. 8. Shall I bring you some silk from Paris? 9. Bring me what you can; no matter what. 10. Does that concern your brother? 11. That does not concern him, but it concerns me. 12. Does he refuse to write to us? 13. He refuses to (de) write; but what does it matter? 14. Bring me a book, no matter which. 15. Your brother will come, will he not? 16. Has he been willing to receive your brother? 17. He has refused to receive him, but no matter. 18. He is pleased, is he not? 19. He is not pleased, but it is no matter. 20. Is that your business? 21. It is my business. 22. It is my brother's business. 23. I have told you that it is nobody's business. 24. Has that man a design against your father's life? 25. He has no design against his life; but he has a design upon his property. 26. Are you angry with us on that account? 27. I am not angry with you for this. 28. Have you a grudge against my friends? 29. I have no grudge against them. 30. That concerns you, does it not? 31. That concerns me. 32. Is that your business? 33. It is very warm this morning; is it not?

KEY TO EXERCISES TO LESSONS IN FRENCH.

EXERCISE 83 (Vol. I., page 316).

1. Is the young man gone far? 2. He is not gone very far, he is only gone as far as Paris. 3. Your children make too much noise, why do you not take them away? 4. They are sick, they cannot walk. 5. How have you brought them here? 6. I brought them in a carriage. 7. At what hour do you bring the physician? 8. I bring him every day at twelve (noon). 9. How many times a day do you take your pupils to church? 10. I take them to church twice a day. 11. How many times have you been there? 12. I have been there several times. 13. Which way did those travellers come? 14. They came through Amiens and Rouen. 15. Whence do you bring this news? 16. I bring it from Cologne. 17. Whence have you brought those superb horses? 18. I have brought them from England. 19. If you leave France, do you intend to take your son with you? (to take away your son?) 20. I intend to take him with me. 21. What have you brought from France? 22. We have brought magnificent silk goods, fine clothes, and Lyons hats. 23. Have you brought your daughter on foot or on horseback? 24. I brought her in a carriage. 25. Your brothers have brought us books.

EXERCISE 84 (Vol. I., page 317).

1. Combien de temps M. votre fils a-t-il demeuré à Londres? 2. Il y a demeuré dix ans. 3. Jusqu'où le médecin est-il allé? 4. Le médecin est allé jusqu'à Cologne. 5. A-t-il emmené son fils avec lui? 6. Il ne l'a pas emmené. 7. Comment avez-vous amené vos deux petites filles? 8. J'en ai amené une en voiture, et j'ai porté l'autre. 9. Est-elle trop petite pour marcher? 10. Elle n'est pas trop petite.

pour marcher, mais elle est malade. 11. Avez-vous amené votre cheval? 12. Nous avons amené deux chevaux. 13. Avez-vous apporté les livres que vous m'avez promis? 14. J'ai oublié de les apporter. 15. Cette dame a-t-elle amené son fils aîné? 16. Elle a amené tous ses enfants. 17. Comment sont-ils venus? 18. Ils sont venus en voiture. 19. Par où M. votre frère est-il venu d'Allemagne? 20. Il est venu par Aix-la-Chapelle et par Bruxelles. 21. Avez-vous l'intention de mener votre fils à l'école, cette après-midi? 22. Je n'ai pas l'intention de l'y mener, il fait trop froid. 23. Cet enfant est-il trop malade pour marcher? 24. Il est trop malade pour marcher, et j'ai l'intention de le porter. 25. Pourquoi ne l'emmenez-vous pas en voiture? 26. Mon frère a emmené mon cheval. 27. Avez-vous amené le médecin? 28. Je ne l'ai pas amené, il n'y a personne de malade chez nous. 29. Voulez-vous porter ce livre à l'église? 30. J'en ai un autre, je n'en ai pas besoin. 31. Avez-vous porté ma lettre à la poste? 32. Je l'ai oubliée. 33. Jusqu'à quelle heure avez-vous écrit? 34. J'ai écrit jusqu'à minuit. 35. D'où Mmes vos sœurs viennent-elles? 36. Elles viennent de Paris.

EXERCISE 85 (Vol. I., page 333).

1. To whom did your sisters apply? 2. They applied to me. 3. Have they not made a mistake? 4. They have made a mistake. 5. Did you perceive your error? 6. I have not perceived it. 7. Did you become weary of the country? 8. We became weary of it. 9. Did those young ladies become weary of remaining at your house (feel ennuï at your house)? 10. They did. 11. What did you use for writing, Madam (Mlle)? 12. I used a gold pen. 13. Did not those scholars use steel pens? 14. They used silver pens. 15. Did the Dutch lady sit down? 16. She did not sit down. 17. Has a misfortune happened to her? 18. Nothing has happened to her, she is not well. 19. Has she not given herself (taken) trouble for nothing? 20. Has not that silk sold well? 21. It has sold very well. 22. Has it not been fine weather the whole day? 23. No, Sir, it has rained, snowed, and hailed. 24. Has nothing happened to the two ladies whom we have seen this morning? 25. No, Madam, nothing has happened to them.

EXERCISE 86 (Vol. I., page 333).

1. A-t-il plu aujourd'hui? 2. Il n'a pas plu, mais il a grêlé et neige. 3. Est-il arrivé quelque chose à votre petit garçon? 4. Il ne lui est rien arrivé, mais il est malade aujourd'hui. 5. Votre sœur s'est-elle assise chez vous? 6. Elle ne s'est pas assise, elle était malade. 7. Ce drap s'est-il bien vendu? 8. Il s'est très bien vendu, nous l'avons tout vendu. 9. Vous êtes-vous aperçus de votre erreur? 10. Nous nous en sommes aperçus. 11. Mmes vos sœurs ne se sont-elles pas trompées dans cette affaire? 12. Elles ne se sont pas trompées. 13. Vos cousines ne se sont-elles pas ennuyées à la campagne? 14. Elles se sont ennuyées chez mon frère. 15. De quoi vous êtes-vous servi pour écrire vos thèmes? 16. Je me suis servi d'une plume d'or, et mon frère s'est servi d'une plume d'argent. 17. Vous êtes-vous servi de mon canif? 18. Je m'en suis servi. 19. Que vous est-il arrivé? 20. Il ne m'est rien arrivé. 21. Mme votre mère s'est-elle bien portée? 22. Elle ne s'est pas bien portée. 23. Vos frères se sont-ils appliqués à leurs études à l'école? 24. Ils se sont appliqués à leurs études et ils ont fini leurs leçons. 25. Quel temps a-t-il fait ce matin? 26. Il a fait très beau temps. 27. Mlle votre sœur s'est-elle donnée beaucoup de peine dans cette affaire? 28. Elle s'est donnée beaucoup de peine pour rien. 29. Les Hollandaises se sont-elles promenées? 30. Elles se sont promenées ce matin. 31. Jusqu'où sont-elles allées? 32. Elles sont allées jusque chez M. votre frère. 33. Vous êtes-vous donné la main? 34. Nous nous sommes donné la main. 35. Ces dames se sont beaucoup flattées.

EXERCISE 87 (Vol. I., page 333).

1. Is your mother loved by her sister? 2. She is loved by her brother and by her sister. 3. Are the Italians loved by the French? 4. Are not your scholars blamed? 5. They are blamed sometimes. 6. Are they often punished? 7. They are seldom punished. 8. By whom are you punished when you are idle? 9. I am never punished. 10. Has his conduct been approved? 11. It has been approved by everybody. 12. It has been approved by his friends. 13. Is that author esteemed? 14. He is esteemed by everybody. 15. Is the book-binder's garden to be sold or to be let? 16. It is said that it is to be let. 17. Has the joiner had a coat made? 18. He has had two made. 19. Are the coats which you have bought worn out? 20. They are worn out; I have had others made. 21. Is it said that our friends are loved by everybody? 22. People do not say so, for people do not believe it. 23. Are the ladies, whom we saw at church last evening, sisters? 24. They are not, it is said that they are cousins. 25. It is said that the officer who is just arrived is called S.

EXERCISE 88 (Vol. I., page 334).

1. Êtes-vous blâmé ou loué? 2. Je ne suis ni blâmé ni loué. 3. Votre cousin n'est-elle pas estimée de tout le monde? 4. Elle n'est estimée de personne. 5. Qu'a-t-on dit de mon frère? 6. On n'a rien dit de lui. 7. Savez-vous si la maison de votre frère est à louer? 8. On m'a dit qu'elle est à vendre. 9. Un paresseux n'est-il pas à plaindre? 10. Le paresseux est à plaindre. 11. Votre fils est-il quel-quefois puni à l'école? 12. On le punit toujours (il est toujours puni), quand il est paresseux. 13. Vos écoliers sont-ils loués, quand ils sont

appliqués? 14. Ils sont loués quand ils sont appliqués, et ils sont blâmés quand ils sont paresseux. 15. Cette dame est-elle estimée et respectée? 16. Elle est aimée, estimée et respectée de tout le monde. 17. Que vous a-t-on dit? 18. On nous a dit que M. votre frère est respecté de tout le monde. 19. Madame, êtes-vous la sœur de M. S.? 20. Non, Monsieur, je ne la suis pas. 21. Madame, êtes-vous contente de la conduite de votre fils? 22. Non, Monsieur, je ne le suis pas, car il est blâmé de tout le monde. 23. Comment ce gros homme s'appelle-t-il? 24. On dit qu'il s'appelle H. 25. Comment M. votre frère s'appelle-t-il? 26. Il s'appelle Jacques. 27. Vous a-t-on dit que mon frère est arrivé? 28. On nous l'a dit. 29. Les marchandises que votre frère a apportées, sont-elles à vendre? 30. Elles ne sont pas à vendre. 31. Le relieur s'est-il fait faire un habit? 32. Il s'en est fait faire un. 33. Son autre habit est-il usé? 34. L'habit qu'il a acheté l'année dernière est usé.

LESSONS IN GEOGRAPHY.—XXVIII.

TABLE OF LATITUDES AND LONGITUDES OF PLACES IN EUROPE.

In the present lesson we continue and bring to a conclusion our table of the latitudes and longitudes of places in the Continent of Europe.

Name of Place.	Country, etc.	Latitude.	Longitude.
Needles Lighthouse	England.	50° 39' N.	1° 36' W.
Negropont	Archipelago	38 27	23 36 E.
Neustadt	Austria	47 49	16 15 E.
Nevers	France	47 0	3 9 E.
Newark	England	53 4	0 49 W.
Newbury	England	51 55	1 20 W.
Nice	France	43 44	7 14 E.
Nieuport	Belgium	51 8	2 44 E.
Nimeguen, or Nymegen	The Netherlands	51 51	5 52 E.
Nîmes, or Nismes	France	43 51	4 21 E.
Nishnij, or Nijni Novgorod	Russia	56 18	44 2 E.
Nogent-sur-Seine	France	48 29	3 30 E.
Noirmoutier (I. de)	France	47 0	2 15 W.
Nordkyn (Cape)	Norway	71 9	27° 42 E.
Nordlingen	Bavaria	48 51	10 29 E.
North Cape	Norway	71 12	25 46 E.
Nottingham	England	52 57	1 8 W.
Novara	Italy	45 27	8 38 E.
Novgorod	Russia	58 36	31 17 E.
Nuremberg	Bavaria	49 27	11 5 E.
Oczakow	Russia	46 37	31 30 E.
Odesa	Russia	46 28	30 43 E.
Oldenburg	Germany	53 8	8 12 E.
Oleron	France	43 12	0 35 E.
Omer, St.	France	50 45	2 15 E.
Onega	Russia	63 53	38 4 E.
Oporto	Portugal	41 7	8 33 W.
Orelbro	Sweden	59 16	15 12 E.
Orel	Russia	52 55	36 7 E.
Orford Lighthouse	England	52 6	1 32 E.
Orleans	France	47 54	1 55 E.
Ortega (Cape)	Spain	43 47	7 53 W.
Osnaburg	Prussia	52 17	8 3 E.
Ostend	Belgium	51 14	2 54 E.
Otranto	Italy	40 8	13 30 E.
Oxford	England	51 46	1 16 W.
Paderborn	Prussia	51 43	8 45 E.
Padua	Italy	45 23	11 53 E.
Palermo	Sicily	38 7	13 22 E.
Palma, Majorca (I.)	Mediterranean Sea	39 35	2 43 E.
Pamplona	Spain	42 50	1 12 W.
Paris	France	48 50	2 20 E.
Parma	Italy	44 48	10 19 E.
Paros (I.)	Archipelago	37 2	25 11 E.
Pavia	Italy	45 11	9 9 E.
Peniscola	Spain	40 24	0 25 E.
Penrith	England	54 41	2 45 W.
Perekop	Russia	46 8	33 40 E.
Perigueux	France	45 11	0 44 E.
Perm	Russia	58 1	56 32 E.
Perpignan	France	42 43	2 53 E.
Pesaro	Italy	43 55	12 53 E.
Peterborough	England	52 35	0 16 W.
Petersburg, St.	Russia	59 58	30 26 E.
Piacenza	Italy	45 3	9 40 E.

Name of Place.	Country, etc.	Latitude.	Longitude.	Name of Place.	Country, etc.	Latitude.	Longitude.
Pillau	Prussia	54° 40' N.	19° 56' E.	Tarragona	Spain	41° 8' N.	1° 13' E.
Pilsen	Austria	49 45	13 23 E.	Taunton	England	51 2	3 7 W.
Piombino	Italy	42 55	10 31 E.	Teherkask	Russia	47 23	40 17 E.
Pisa	Italy	43 43	10 23 E.	Tecklenburg	Prussia	52 13	7 49 E.
Plymouth	England	50 22	4 9 W.	Tenby	Wales	51 41	4 42 W.
Poitiers	France	46 34	0 22 E.	Tenedos (I.)	Archipelago	39 48	26 2 E.
Pola	Austria	44 53	13 52 E.	Terracina	Italy	41 17	13 17 E.
Polotsk	Russia	55 29	28 47 E.	Terranova	Sicily	37 3	14 16 E.
Poole	England	50 43	1 59 W.	Torneafors	Sweden	67 33	22 19 E.
Potland Lighthouse	England	50 31	2 27 W.	Tortona	Italy	44 53	8 52 E.
Porto-Vecchio	Corsica	41 35	9 15 E.	Tortosa	Spain	40 50	0 30 E.
Portsmouth	England	50 48	1 6 W.	Toulon	France	43 7	5 56 E.
Prague	Germany	50 5	14 26 E.	Toulouse.	France	43 36	1 27 E.
Presburg	Hungary	48 8	17 10 E.	Tournay	Belgium	50 37	3 22 E.
Quentin, St.	France	49 50	3 17 E.	Tours	France	47 23	0 42 E.
Quimper.	France	48 0	4 4 W.	Trafalgar (Cape)	Spain	36 11	6 3 W.
Ramsey (I. of Man).	England	54 19	4 23 W.	Trapani	Sicily	38 3	12 32 E.
Ratisbon	Bavaria	49 1	12 6 E.	Trent	Austria	46 4	11 7 E.
Ravenna.	Italy	44 25	12 12 E.	Treves, or Trier	Prussia	49 44	C 38 E.
Ré (I. de)	France	46 11	1 25 W.	Trieste	Austria	45 39	13 47 E.
Rendsburg	Prussia	54 18	9 40 E.	Tripolitza	Greece	37 30	22 22 E.
Rennes	France	48 6	1 40 W.	Troyes	France	48 18	4 4 E.
Revel	Russia	59 27	24 49 E.	Tubingen	Württemberg	48 31	9 3 E.
Rheims	France	49 15	4 2 E.	Tula	Russia	54 11	37 41 E.
Rhodes (I.)	Archipelago	36 10	28 0 E.	Tunbridge	England	51 12	0 17 E.
Riga	Russia	56 57	24 3 E.	Turin	Italy	45 3	7 41 E.
Rimini	Italy	44 3	12 33 E.	Tver	Russia	56 50	35 59 E.
Rocheport-sur-Mer	France	45 56	0 57 W.	Tynmouth	England	55 1	1 26 W.
Rochelle	France	46 9	1 9 W.	Udine	Italy	46 4	13 13 E.
Rodosto.	Turkey	41 0	27 31 E.	Ulm	Württemberg	48 24	9 59 E.
Rome	Italy	41 54	12 29 E.	Umea	Sweden	63 49	20 9 E.
Ronda	Spain	36 49	5 18 E.	Upsala	Sweden	59 49	17 38 E.
Rotterdam	The Netherlands	51 55	4 29 E.	Ursals	Russia	51 16	51 28 E.
Rouen	France	49 26	1 6 E.	Urbino	Italy	43 43	12 38 E.
Rugen (I.)	Prussia	54 30	13 30 E.	Ushant (I.)	France	48 28	5 3 W.
Ruremonde	The Netherlands	51 12	5 59 E.	Utrecht	The Netherlands	52 5	5 7 E.
Ripen, or Ribe	Denmark	55 19	8 46 E.	Valencia.	Spain	39 29	0 24 W.
Saintes	France	45 44	0 38 W.	Valetta	Malta	35 54	14 31 E.
Salisbury	England	51 4	1 48 W.	Valona	Turkey	40 29	19 26 E.
Salonika	Turkey	40 38	22 56 E.	Vannes	France	47 47	2 45 W.
Salzburg.	Austria	47 48	13 3 E.	Venice	Italy	45 26	12 18 E.
Santander	Spain	43 30	3 51 W.	Venlo	The Netherlands	51 22	6 10 E.
Saratov	Russia	51 31	46 0 E.	Verden	Prussia	52 56	9 12 E.
Sark (I.)	English Channel	49 27	2 22 W.	Verdun	France	49 10	5 22 E.
Schiedam	The Netherlands	51 54	4 24 E.	Verona	Italy	45 26	11 0 E.
Schleswig	Prussia	54 31	3 1 E.	Versailles	France	48 47	2 7 E.
Schmalkalden.	Prussia	50 43	10 28 E.	Vicenza.	Italy	45 32	11 32 E.
Schweidnitz	Prussia	50 50	16 28 E.	Vienna	Austria	48 13	16 22 E.
Schwierin	Germany	53 38	11 25 E.	Vigo	Spain	42 14	8 41 W.
Sebastien, St.	France	46 23	1 33 E.	Villach	Austria	46 37	13 50 E.
Seitval	Portugal	38 32	8 55 E.	Vilhialando	Spain	41 51	5 26 W.
Sheerness	England	51 27	0 45 E.	Vincent, Cape St.	Portugal	37 4	9 0 W.
Shrewsbury	England	52 43	2 46 W.	Viviers	France	44 29	4 41 E.
Sienna	Italy	43 20	11 19 E.	Vologda.	Russia	59 12	39 56 E.
Simpferopol	Crimea	41 56	34 5 E.	Voronetz	Russia	51 46	33 28 E.
Skagen (Cape).	Denmark	57 43	10 38 E.	Wakefield	England	53 42	1 30 W.
Sonderburg	Prussia	54 54	9 47 E.	Waldeck	Prussia	51 12	9 4 E.
Sonderholm	Denmark	57 0	9 42 E.	Wardhuus, or Var-	Norway	70 21	31 7 E.
Southampton	England	50 54	1 23 W.	dohuus	England	53 23	2 36 W.
Spartivento (Cape)	Italy	37 58	16 6 E.	Warrington	England	53 21	2 36 W.
Spezia	Italy	44 6	9 48 E.	Warsaw	Russia	52 14	21 7 E.
Spies, or Speyer	Bavaria	49 18	8 26 E.	Weimar	Germany	50 59	11 19 E.
Spoleto	Italy	42 44	12 44 E.	Wesel	Prussia	51 39	6 36 E.
Stade	Prussia	53 36	9 27 E.	Whitehaven	England	54 33	3 35 W.
Staples, or Fern Lt.	England	55 38	1 37 W.	Wiborg, or Viborg.	Denmark	56 27	9 22 E.
Start Point	England	50 13	3 38 W.	Wiborg, or Viborg.	Russia	60 47	28 43 E.
Stavanger	Norway	59 0	5 39 E.	Wicklow	Ireland	52 58	6 2 W.
Stockholm	Sweden	59 17	18 3 E.	Wilna	Russia	54 40	25 13 E.
Stolberg	Saxony	50 42	12 47 E.	Winchester	England	51 3	1 18 W.
Strabane	Ireland	54 49	7 27 W.	Windsor.	England	51 28	0 37 W.
Stralsund	Germany	54 20	13 5 E.	Wittenburg	Saxony	51 52	12 39 E.
Strasbourg	Alsace	48 36	7 42 E.	Wolffenbüttel	Germany	52 9	10 31 E.
Strelitz	Germany	53 20	13 3 E.	Wolverhampton	England	52 37	2 8 W.
Stromboli (I.)	Mediterranean Sea	38 47	15 13 E.	Workington	England	54 38	3 33 W.
Stromness	Orkneys	58 57	3 17 W.	Worms	Hesse-Darmstadt	49 38	8 21 E.
Stuttgart	Württemberg	48 48	9 10 E.	Würzburg	Bavaria	49 47	9 56 E.
Sunderland	England	54 54	1 23 W.	Ypres	Belgium	50 52	2 53 E.
Swansea.	Wales	51 37	3 57 W.	Zante (I.)	Mediterranean	37 47	20 55 E.
Syracuse	Sicily	37 3	15 15 E.	Zurich	Switzerland	47 22	8 33 E.
Taganrog	Russia	47 13	38 56 E.	Zutphen.	The Netherlands	52 8	6 12 E.
Tambov	Russia	52 41	41 30 E.	Zywiec	Austria	49 41	19 12 E.
Tania (I.)	Spain	36 1	5 37 W.				

GEOMETRICAL PERSPECTIVE.—VI.

PROBLEM XV. (Fig. 34).—A square pyramid 4 feet side and 6 feet high, one edge of the base at an angle of 60° with the picture plane, and the nearest angle 1 foot within the picture. The base of the pyramid must be treated as the square in Problem X., Fig. 25, Vol. II., page 361; after which draw the diagonals in the perspective projection, namely, $a b$ and $c d$; their intersection will determine the perspective of the centre e , from which erect a perpendicular $e f$; this will be the axis of the pyramid. From DE^* draw a line through the centre of the base to the picture plane at g , from which draw the line of contact, and upon it from g set off the given height of the pyramid $g h$. Draw the retiring line from h to VP , and at the point where this intersects the axis $e f$ will be found the perspective height of the pyramid, namely, at i . Draw lines from the angles a, b, c, d to i , to represent the inclined edges of the pyramid; this will complete the problem. If we place the ground plan beyond the picture plane (Fig. 35) we must proceed as follows: Place the plan with

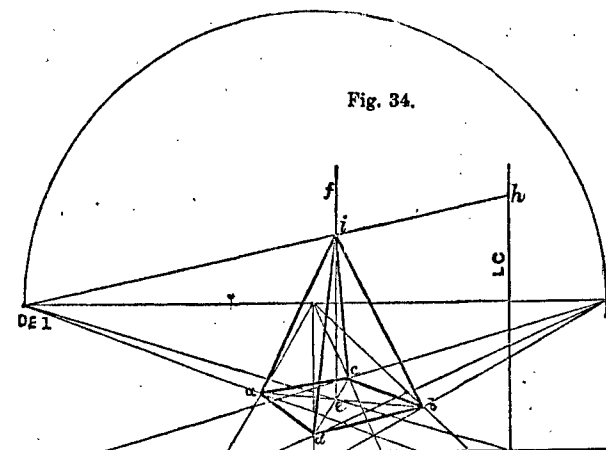


Fig. 34.

give the perspective height of the pyramid. Complete the inclined edges as in Fig. 34. (Observe, we might have drawn $e f$ not parallel to the side of the square; in that case we should have been compelled to find another vanishing point; therefore to save extra work we draw it parallel to the side of the square, so that we may make use of the VP of that side. Definition 13, Vol. II., page 162.)

PROBLEM XVI.—A cone 4 feet diameter and 6 feet high. This will be done from almost the same directions as the pyramid. Look back to Problem XII., Fig. 31, Vol. III., page 9, where we have the perspective of a circle. Now the base of the cone, being a circle, must be treated in the same way. To draw the elevation, draw a perpendicular line, the line of contact from d or b (Fig. 31); mark off upon this line the given height, and from that point draw a line to the respective VP ; thus, if the line of contact is from d , DE^* will be its VP ; a perpendicular line drawn from the centre of the circle to cut this vanishing line will be the axis, and the point of intersection will mark the apex, from which draw lines to o and p for the sides of the cone.

back to Problem XII., Fig. 31, Vol. III., page 9, where we have the perspective of a circle. Now the base of the cone, being a circle, must be treated in the same way. To draw the elevation, draw a perpendicular line, the line of contact from d or b (Fig. 31); mark off upon this line the given height, and from that point draw a line to the respective VP ; thus, if the line of contact is from d , DE^* will be its VP ; a perpendicular line drawn from the centre of the circle to cut this vanishing line will be the axis, and the point of intersection will mark the apex, from which draw lines to o and p for the sides of the cone.

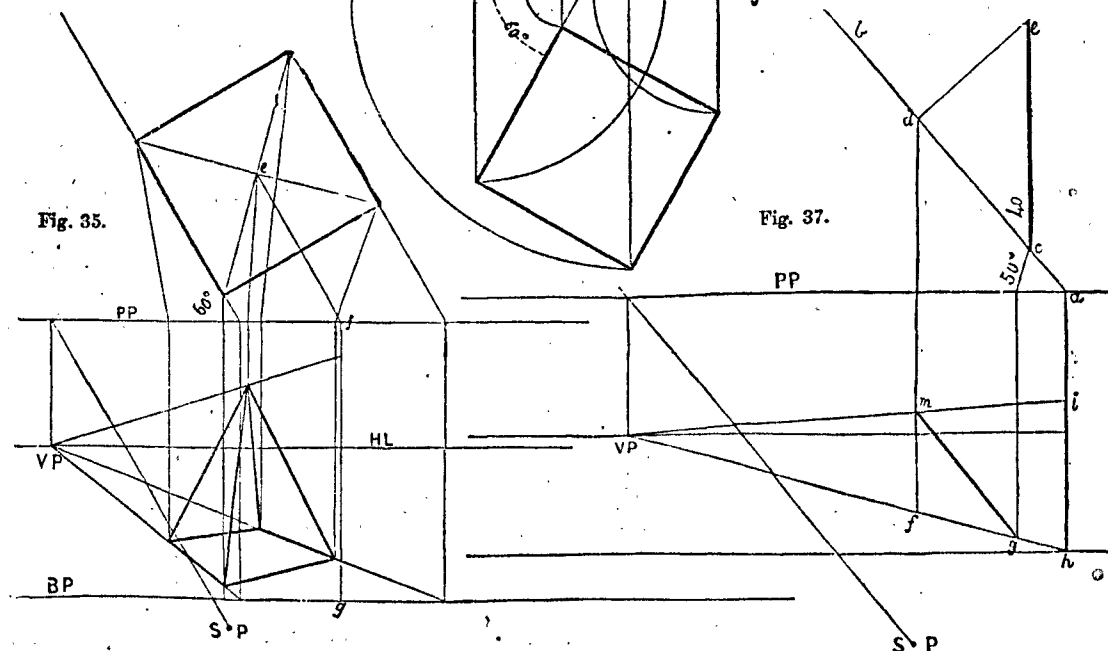


Fig. 35.

Fig. 37.

the PP , as required by the question, and produce two of the parallel sides to the PP , to be continued perpendicularly to the base of the picture, from which draw the retiring lines to the VP . Visual rays from each angle of the plan, cutting the retiring lines, will give the positions of the angles of the square. This method of using only one VP has been fully explained in Lesson V.; we trust the pupil will make himself master of it, as we shall have to employ it very frequently. For the elevation, diagonals may be drawn and the subject completed as in Fig. 34; but we will show another way, and draw the diagonals in the ground plan which give the centre e . Draw $e f$ parallel to the side of the square, and the perpendicular line $f g$, the line of contact. Upon $f g$ mark the given height of the pyramid $g h$, and from h draw a line to VP ; a visual ray drawn from the centre e of the plan, cutting the line from h to the VP , will

PROBLEM XVII. (Fig. 36).—A cylinder 4 feet diameter and 8 feet high stands on its end; the eye is opposite half the height of the cylinder. In working this problem we prefer placing the plan beyond the PP , it being necessary to draw a circle for each end of the cylinder, therefore the same perpendicular lines drawn from the plan will answer for both. It will be seen that when these perpendiculars have reached the base of the picture other lines are drawn from them to the rs , and the circle is drawn by hand as in Fig. 31, Vol. III., page 9. For the upper circle, $a b$ is drawn horizontally across the perpendiculars according to the height of the cylinder, and the same process with regard to the circle is followed as in the one for the base; lastly, lines c, d , drawn tangential to the outer edges of the circles, will give the sides of the cylinder.

PROBLEM XVIII. (Fig. 37).—To draw the perspective representation of an incline. A rod 5 feet long is inclined to the horizon 40° . The plan of the rod is 50° with the picture plane, the nearest end 1 foot from it. In this case the vanishing point of the plan of the rod must be found, and not that of the rod itself. We intend in a future lesson to show how the vanishing point for an incline may be found without a plan, giving only the dimensions and positions, and the method of using it; but for the present turn back to Problem IV.; Fig. 14 (Vol. II., page 297), where the same subject is shown in orthographic projection; the rod is there placed at a given angle with the ground, xy , and perpendiculars are drawn from the extremities between which the line $a b$, the plan, is drawn. Now we must first project the rod orthographically in order to determine the plan preparatory to drawing it perspective. An indefinite line $a b$ must be drawn at an angle of 50° with the picture plane; c is the point where the rod touches the ground, draw $c e$ 5 feet long at an angle of 40° with $a b$; draw $e d$ perpendicularly to $a b$; $c d$ will then be the plan of the rod; complete the perspective representation of $c d$, which will be $f g$ (see Fig. 7, Lesson II., Vol. II., page 225). This last observation refers to the perspective only of the plan; we must now represent the rod in its inclined position. As one end of the rod is on the ground, and the other above it, our attention must be directed to the elevated end, because the lower end is already found in g . It must be evident, on turning once more to Fig. 7, that the line $f g$ is the perspective of the line $d c$; and since the line $d c$ is the plan of the given line $e c$, therefore e must be perpendicularly over d . The question now comes to this: how far above d ? We answer, the length of $d e$, which must be set off on the line of contact, namely, $h i$. From i draw a line to the VP , and the point m where the line from i to VP cuts the visual ray from d will determine the position of the upper end of the rod; join $m g$, which will be the perspective representation of the rod.

PROBLEM XIX. (Fig. 39).—A square board is inclined to the horizon at an angle of 48° ; one edge is horizontal, the plan of the inclined edge of the board is 50° with the picture plane; length of side 6 feet. The scale may be either 4 feet or 2 feet to the inch. (We give the pupil the choice. and

observe that as his knowledge and confidence increase he should, when he repeats the problems, take other angles and other scales of proportion. This kind of repetition will be of great service to him.) We must first show the orthographic projection of the board (Fig. 38), and then apply it to the perspective projection. When the board is horizontal, or laid upon the ground, the plan will be a square, $a b c d$; but if we raise the side $a c$, allowing the edge $b d$ to remain upon the ground, it would then be inclined to the horizon as represented by the line or edge of the board, $e f$; drop a perpendicular from f , then the plan is projected by $a' b' c' d'$. Observe, if the edge of the board were still further elevated, the plan would become narrower, that is, $a' c'$ would approach $b d$. When the board becomes perpendicular to the ground, then the plan would be a line only (see the observations made upon the circle, Figs. 10 and 11, Lesson III., Vol. II., page 297). We will now proceed with the perspective projection of the board as given in the question; it is there stated that the edge of the board is inclined at 50° with the PP ; therefore draw an indefinite line $d e$ at that angle, make $d b$ equal to the length of a side, and at a right angle with $d e$; this is the edge upon which it rests, and is horizontal; draw $b h$ parallel to $d e$; draw $b f$ at an angle of 48° with $b h$, and make it equal to $b d$; from f draw perpendicularly to $b h$ the line $f a' c'$; we shall then have in the parallelogram $a' c' b d$ the plan of the board at the given inclination. The angle d of the board touches the picture plane, therefore d is a point of contact; also the line $b a'$ is produced to the picture plane at m ; $d u$ and $m o$ are lines of contact upon each of which the height of the inclination of the board $a' f$ is set off as $o p$ and $u p$; from the points p, p draw lines to the VP . Visual rays cutting these lines will give the upper angles of the board, $r s$; $u t s r$ will be the perspective view of the board.

After this, we recommend the pupil to apply the same directions and angles of inclination in representing an equilateral triangle, making the edge equal to $d b$ at 40° with the PP ; $b f$, the inclination, will be equal to a perpendicular from the centre of the base to the opposite angle, placed in the plan half way between $c' a'$. To find the perpendicular, the triangle must be separately constructed.

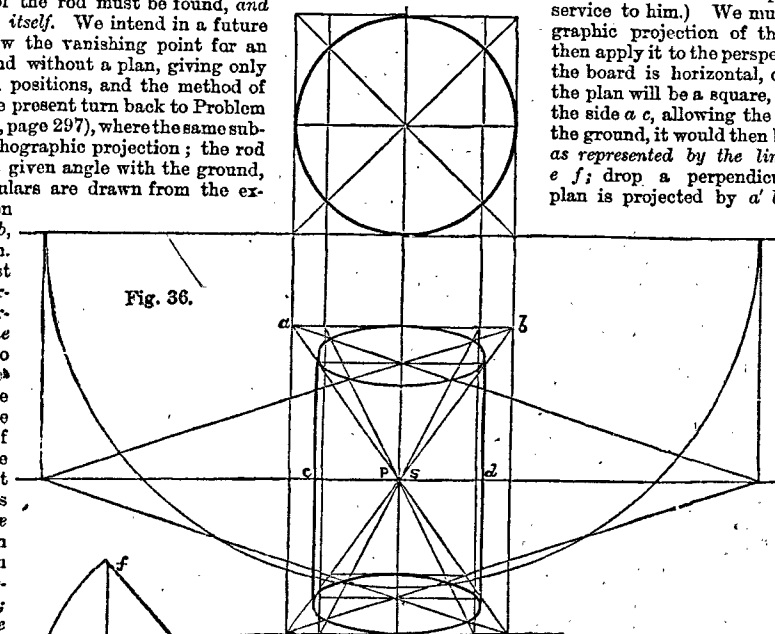


Fig. 36.

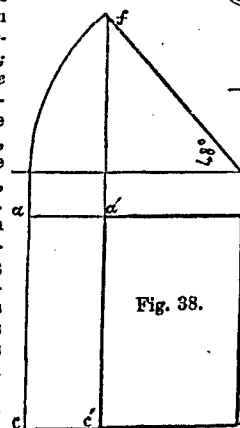


Fig. 38.

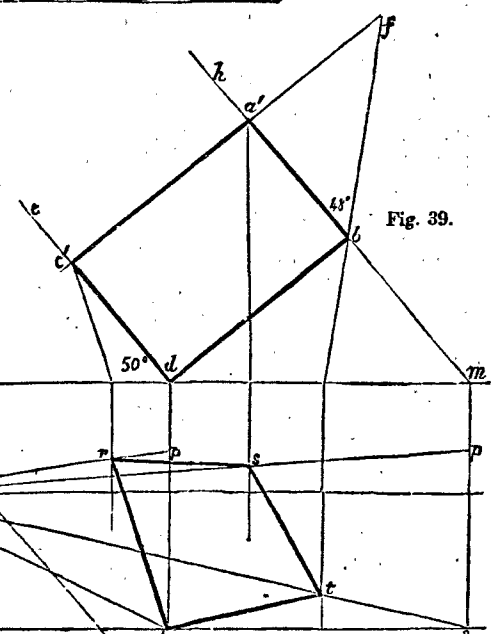


Fig. 39.

LESSONS IN LATIN.—XXVIII.

REGULAR VERBS.—THE THIRD CONJUGATION.

PASSIVE VOICE.

EXAMPLE.—Lēgor, 3, I am read.

Chief Parts: Lēgor. Lectus sum, lēgi. Characteristic letter, e short.

PRESENT TENSE.

Indicative.	Subjunctive.	Imperative.	Infinitive.	Participle.
Sing. Lēgor.	Lēgar.	Lēgtor.	Lēgi.	
Legis.	Legar.	Lēgtor or		
Legitur.	Legatur.	Lēgtor.		
Plu. Legimur.	Legamur.	Lēgtimur.		
Legimini.	Legamini.	Lēgtimini or		
Leguntur.	Legantur.	Lēgtuntur.		

IMPERFECT TENSE.

Sing. Legēbar.	Legērer.			
Legēbāris (e).	Legēreris.			
Legēbatur.	Legēretur.			
Plu. Legēbamur.	Legēremur.			
Legēbamini.	Legēremini.			
Legēbantur.	Legērentur.			

FIRST FUTURE TENSE.

Sing. Lēgar.				
Legāris (e).				
Legatur.		Lectum	Legendus	
Plu. Legemur.		[iri.]		
Legimini.				
Leguntur.				

PERFECT TENSE.

Sing. Lectus sum.	Lectus sim.		Lectum	Lectus.
Lectus es.	Lectus sis.		[esse.]	
Lectus est.	Lectus sit.			
Plu. Lecti sumus.	Lecti simus.			
Lecti estis.	Lecti sitis.			
Lecti sunt.	Lecti sint.			

PLUPERFECT TENSE.

Sing. Lectus eram.	Lectus essem.			
Lectus eras.	Lectus esses.			
Lectus erat.	Lectus esset.			
Plu. Lecti erāmus.	Lecti essemus.			
Lecti eratis.	Lecti essetis.			
Lecti erant.	Lecti essent.			

SECOND FUTURE TENSE.

Sing. Lectus ero.				
Lectus eris.				
Lectus erit.				
Plu. Lecti erimus.				
Lecti eritis.				
Lecti erunt.				

Instances.—In this way conjugate in full, agor, agi, actum esse, I am driven; regor, regi, rectum esse, I am ruled; and dividor, dividi, divisum esse, I am divided. By conjugating verbs in full after the models given in our lessons, the self-teacher will gain facility in recognising and determining the different tenses of the different moods of Latin verbs of the four conjugations, both in the active and passive voice, at sight. The vocabularies given in the different lessons will supply the student with abundant examples for practice.

VOCABULARY.

Conspicio, conspicer.	Dives, divitis, rich, a	Quidam, quōdam,
conspexi, conspec-	rich man.	quoddam, certain.
tum, 3, I behold.	Divitia, -arum, pl., f.,	Quoad, adv., as long as.
Contemno, contem-	riches.	Schola, -ae, f., a school.
nere, contempsi, con-	Educo, 3, I lead out.	Scriptor, -oris, m., a
temptum, 3, I de-	Honos, -oris, m.,	writer (E. R. scrip-
spise, contemn.	honour.	ture).
Cura mihi est, it is an	Pie, piously, reli-	Societas, -atis, f., rela-
object of care to me,	giously.	tionship (E. R.
or I take pains that.	Probe, honestly, excel-	society).
Detego, detegere, de-	lently.	Vix, scarcely.
texi, detectum, 3, I	Que, and; this comes	Voluptas, -atis, f.,
uncover, detect, lay	after the word, as	pleasure, delight.
open.	voluptasque.	

EXERCISE 98.—LATIN-ENGLISH.

1. Pater curat ut ego strenue excolar. 2. Curo ut puer bene excolatur. 3. Pater curabat ut puer bene excoleretur. 4. Cura mihi est ut a te diligar. 5. Conjuratio Catilinæ a Cicerone detecta est. 6. Tria bella atrocissima gesta sunt inter Romanos et Carthaginienses. 7. Labor voluptasque naturali quadam societate inter se juncta sunt. 8. Multæ urbes ab hostibus combustæ sunt. 9. Vix hostes conspecti

erant quum milites a duce e castris in aciem educti sunt. 10. Metuebamus ne urbs ab hostibus obsidione cincta esset. 11. Deus ple colitor. 12. Leges divinas ne contemnantur. 13. Sapientes semper ratione regi student. 14. Pueri probe excolendi sunt. 15. Ne vincitor cupiditatibus. 16. Non eris dives nisi divitiis a te contemptis erant. 17. Contemnens voluptates, diligēris. 18. Quoad literis honores erit, Græci et Latini scriptores in scholis legentur.

EXERCISE 99.—ENGLISH-LATIN.

1. My mind will be cultivated. 2. My brother's mind has been cultivated. 3. If thy mind is well cultivated, thou wilt be loved. 4. Riches are despised by the wise. 5. Riches will be despised by me. 6. Riches will have been despised by my father. 7. Let riches be despised by thee, my son. 8. He strives (studet) to be governed, by reason. 9. The boy must be well cultivated. 10. Let the boy be well cultivated. 11. I have taken care that pleasures should be despised by my children. 12. The Latin writers are read in my school. 13. If thou livest well, thou wilt be loved by good men. 14. I fear riches will (may) not be despised by thee. 15. Many wars have been carried on by the English. 16. The city was burnt by the enemies.

THE FOURTH CONJUGATION.

ACTIVE VOICE.

EXAMPLE.—Audīo, 4, I hear.

Chief Parts: Audīo, audīvi, auditum, audire. Characteristic letter, i long.

PRESENT TENSE.

Indicative.	Subjunctive.	Imperative.	Infinitive.	Participle.
Sing. Audīo.	Audiam.	[audito.]	Audire.	Audiens.
Audis.	Audias.	Audi or		
Audiat.	Audiat.	Audito.		
Plu. Audīmus.	Audīamus.	[audītote.]		
Auditis.	Audiatis.	Audite or		
Audiant.	Audiant.	Audiunto.		

IMPERFECT TENSE.

Sing. Audībam.	Audirem.			
Audiebas.	Audires.			
Audiebat.	Audiret.			
Plu. Audībāmus.	Audirēmus.			
Audiebatis.	Audiretis.			
Audiebant.	Audirent.			

FIRST FUTURE TENSE.

Sing. Audīam.			Auditūrum	Auditurus.
Audis.			[esse.]	
Audiat.				
Plu. Audīamus.				
Auditis.				
Audiant.				

PERFECT TENSE.

Sing. Audīvi.	Audī(v)erim.		Audī(v)isse.	
Audī(v)isti.	Audī(v)eris.			
Audī(v)it.	Audī(v)erit.			
Plu. Audīvimus.	Audī(v)erimus.			
Audī(v)istis.	Audī(v)eritis.			
Audī(v)erunt.	Audī(v)erint.			

PLUPERFECT TENSE.

Sing. Audī(v)eram.	Audī(v)issem.			
Audī(v)eras.	Audī(v)isses.			
Audī(v)erat.	Audī(v)isset.			
Plu. Audī(v)erāmus.	Audī(v)issemus.			
Audī(v)eratis.	Audī(v)issetis.			
Audī(v)erant.	Audī(v)issent.			

SECOND FUTURE TENSE.

Sing. Audī(v)ero.				
Audī(v)eris.				
Audī(v)erit.				
Plu. Audī(v)erimus.				
Audī(v)eritis.				
Audī(v)erint.				

GERUNDS.

Gen. Audiendi.				
Dat. Audiendo.				
Acc. Audiendum.				
Abl. Audiendo.				

SUPINES.

1. Auditum.

2. Auditū.

Instances.—According to the example, form finio, 4, I finish; haurio, hausi, haustum, haurire, 4, I draw up, I drink.

VOCABULARY.

Antequam, before that.	Expedio, 4, with the	Lenio, 4, I soften, soothe.
Corōna, -ae, f., a crown,	reflective pronoun,	Membrum, -i, n., a
chapel.	I prepare.	leaf, or covering.
Custodio, 4, I keep.	Garrō, 4, I chatter.	Munio, 4, I fortify.
Dormio, 4, I sleep.	Lacedæmonii, -orum,	Navigo, 1, I sail (E. R.
Eurio, 4, I am hungry.	m., the Spartans.	navigate).

EXERCISE 102.—LATIN-ENGLISH.

1. Pater curat ut filius bene erudiat. 2. Pater curabat ut filius bene erudiretur. 3. Gives metuunt ne castra ab hostibus ante urbem muniatur. 4. Oculi tenuissimis membranis vestiti sunt. 5. Quum rex urbem intrabat, omnium civium domus coronis et floribus vestitis et ornatis sunt. 6. Non prius dormiēmus quam negotia vestra finita erunt. 7. Simulacra castra munita erunt, milites se ad pugnam expedit. 8. Metuebamus ne urbs ab hostibus obsidione cincta esset. 9. Improbi puniuntur. 10. Bonus discipulus literarum cognitione erudiri studet. 11. Urbs, obsidione cincta, multis malis punitur. 12. Vir eruditus non solum sibi sed etiam aliis prodest. 13. Pueri diligenter erudiendi sunt.

EXERCISE 103.—ENGLISH-LATIN.

1. They are guarded. 2. The city is guarded. 3. The city will be guarded. 4. The city has been guarded. 5. I take care that the city is (may be) guarded. 6. No one doubts that the city is well guarded. 7. The citizens ought to guard the city. 8. Why do not the citizens guard the city? 9. I know not why the citizens do not guard the city. 10. I fear the citizens may not guard the city. 11. They have prepared for the fight. 12. The walls of the house have been clothed with flowers.

KEY TO EXERCISES IN LESSONS IN LATIN.—XXVII.

EXERCISE 94.—LATIN-ENGLISH.

1. I am exercised. 2. Thou art exercised. 3. He is exercised. 4. I was exercised. 5. Thou wast exercised. 6. He was exercised. 7. I shall be exercised. 8. You will be exercised. 9. He will be exercised. 10. Father takes care that I am well exercised. 11. The ditch is filled up. 12. I take care that you are well exercised. 13. I take care that the boy is well exercised. 14. The father took care that his son was well exercised. 15. I took care that you were well exercised. 16. I took care that your daughter was well exercised. 17. Who knows not how our minds are increased by excellent fruits in the pursuit of learning? 18. We fear that our army will (may) be conquered by the enemies. 19. All the citizens feared that the city would be surrounded with a blockade (blockaded) by the enemies. 20. When we are exercised in letters, our minds are increased by the knowledge of many useful things. 21. When we are frightened by a sudden danger, we ought not forthwith to despair of safety. 22. The honour of virtue will be blotted out by no forgetfulness. 23. The boys have been strenuously exercised in the study of letters. 24. We feared that the city had been surrounded by a blockade by the enemies. 25. I fear that the soldiers have been frightened by a sudden danger. 26. Let the boy be strenuously exercised. 27. Be not deterred from the design by the difficulties of things. 28. Good scholars endeavour to be exercised in the study of letters. 29. A boy well educated pleases all. 30. The enemies being terrified remain in the camp. 31. Boys ought to be strenuously exercised.

EXERCISE 95.—ENGLISH-LATIN.

1. Pueri strenue exercentur. 2. Strenue exercentur pueri. 3. Pueri strenue exercendi sunt. 4. Pueri strenue exercebantur. 5. Strenue exercentur pueri. 6. Pueri strenue exercebantur. 7. Pueri strenue exerciti sunt. 8. Pueri strenue exerciti erunt. 9. Curo ut pueri strenue exercentur. 10. Curam ut pueri strenue exercentur. 11. Meae sorores strenue exercitæ sunt. 12. Puella strenue exercita erit. 13. Metuo ne urbs obsidione cingatur.

EXERCISE 96.—LATIN-ENGLISH.

1. We have led. 2. Thou hast led. 3. Thou ledest. 4. I was leading. 5. He will lead. 6. He may lead. 7. While I was painting, thou wast writing, and brother was reading. 8. The enemies were forming a line of battle. 9. As long as you live, you will live well. 10. If you cultivate virtue, good men will love you. 11. The enemies formed a line of battle. 12. The enemies will draw up their line of battle. 13. We have written many letters (of the alphabet) to-day. 14. The enemies carried on a most frightful war. 15. Cæsar had drawn up in line of battle. 16. As soon as we have written the letters, we will walk. 17. I take care that I cultivate the minds of boys. 18. I took care that the teacher cultivated the mind of my son. 19. No one doubts that I have always diligently corrected the boy. 20. We fear that the enemies have burnt the city. 21. No one doubts that the enemies will surround the city with a blockade (will blockade the city). 22. Tell us what your parents have written. 23. Let him write. 24. Learn, O boy. 25. Good boys learn willingly. 26. The soldier, bravely defending himself against enemies, is praised. 27. We ought to restrain our desires.

EXERCISE 97.—ENGLISH-LATIN.

1. Urbem defendi. 2. Milites urbem defendebant. 3. Urbem defendent. 4. Urbem defenderunt. 5. Scribebant. 6. Ille literas scripsit. 7. Nemo dubitat quin tu bonas literas scripturus sis. 8. Cura ut literas scribas. 9. Præceptor curat ut discipuli bonas literas scribant. 10. Hodie literas scripsi. 11. Hostes aciem instruent. 12.

Obedio, 4, I obey, govern the dative (obedioris, syncope for obediatoris).	Prodest, he benefits. Puno, 4, I punish. Simulac, as soon as. Sitio, 4, I thirst (sitior is a syncope for sitivior).	Specto, 1, I regard (id spectant, have this object). Tenuis, -e, thin. Vestio, 4, I clothe (E. R. vest).
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EXERCISE 100.—LATIN-ENGLISH.

1. Milites per totum diem sitiunt et esuriunt. 2. Natura oculis tenuissimis membranis vestit. 3. Cur domus vestra parietes coronis ornatis et vestitis? 4. Præceptoribus vestris placueratis, quia semper præceptis eorum obediatis. 5. Vix milites nostri castra muniverant, quum Cæsar aciem instruxit. 6. Non prius dormiēmus quam negotia nostra finierimus. 7. Quum milites castra muniverant, ad pugnam se expedit. 8. Cavete, pueri, ne garriatis. 9. Lacedæmoniorum leges id spectant ut laboribus erudiant juventutem. 10. Nemo dubitabat quin pueros semper custodivisses. 11. Narra te mihi qua consolatione agrum amici animum leniveritis. 12. Nescio cur puerum puniveritis. 13. Non dubitabam quin præcepta mea memoria custodivissetis. 14. Ne garritote, filii. 15. Venio te rogatum ut mecum ambules. 16. Milites urbem custodire debent. 17. Sapientia est ars videndi. 18. Obediendum est præceptis virtutis. 19. Ars navigandi utilissima est.

EXERCISE 101.—ENGLISH-LATIN.

1. They thirsted. 2. I shall be hungry. 3. Thou wilt not obey my precepts. 4. The boys chatter. 5. They have not obeyed their father. 6. I know not why they have not obeyed their father. 7. No one doubts that good boys obey their father. 8. He kept my words in memory. 9. I shall take care that thou keepest (mayest keep) my words in memory. 10. They come to fortify the city. 11. The art of writing is useful. 12. They adorn the walls of their house with chaplets. 13. I shall not sleep until (before that) I have (shall have) finished my business. 14. Hast thou finished thy business? 15. He was punishing the boy when I entered the school.

THE FOURTH CONJUGATION.

PASSIVE VOICE.

EXAMPLE.—Audīor, 4, I am heard.

Chief Parts: Audīor, audītus sum, audiri. Characteristic letter, i long.

PRESENT TENSE.

Indicative.	Subjunctive.	Imperative.	Infinitive.	Participle.
Sing. Audīor.	Audiar.	[auditor.]	Audiri.	
Audis.	Audias.	Audire or		
Audiat.	Audiat.	Auditor.		
Plu. Audīmur.	Audiamur.	[audimur.]		
Audimini.	Audiamini.	Audimini or		
Audiantur.	Audiantur.	Audiantur.		

IMPERFECT TENSE.

Sing. Audībar.	Audirer.			
Audiebaris (e).	Audireris.			
Audiebatur.	Audiretur.			
Plu. Audībamur.	Audirēmur.			
Audiebamini.	Audirēmini.			
Audiebantur.	Audirentur.			

FIRST FUTURE TENSE.

Sing. Audiar.			Auditūrum	Audiendus.
Audis.			[iri.]	
Audiat.				
Plu. Audiamur.				
Audiamini.				
Audiantur.				

PERFECT TENSE.

Sing. Audītus sum.	Audītus sim.		Auditum	Auditus.
Audītus es.	Audītus sis.		[esse.]	
Audītus est.	Audītus sit.			
Plu. Audītī sumus.	Audītī simus.			
Audītī estis.	Audītī sitis.			
Audītī sunt.	Audītī sint.			

PLUPERFECT TENSE.

Sing. Audītus eram.	Audītus essem.			
Audītus eras.	Audītus esses.			
Audītus erat.	Audītus esset.			
Plu. Audītī erāmus.	Audītī essemus.			
Audītī eratis.	Audītī essetis.			
Audītī erant.	Audītī essent.			

SECOND FUTURE TENSE.

Sing. Audītus ero.				
Audītus eris.				
Audītus erit.				
Plu. Audītī erimus.				
Audītī eritis.				
Audītī erunt.				

Milites urbem combusserunt. 13. Literas legi, quas scripserat. 14. Metuo ne hostes urbem obsidione cincturi sint. 15. Corrige illum puerum. 16. Praeceptor curabit ut discipulos corrigat. 17. Narra mihi, quid patri dixeris. 18. Cupiditates coerceto. 19. Cupiditates coercere debemus. 20. Puer coercens cupiditates amat. 21. Strenuus animum cole, mi fili.

THE HISTORY OF ART.

XIII.—THE FLEMISH AND SPANISH SCHOOLS.

THE progress achieved in the sixteenth century broke down the comparative isolation of the various European countries. Up to the beginning of that time there had been but little international life; each people saw hardly anything of the habits and manners of its neighbours. Hence Art diffused itself but slowly, and while painting in Italy had risen to its greatest heights, it hardly existed as a separate art among the northern nations at all. The matrimonial arrangements, however, which culminated in the conjunction of the Empire, the Low Countries, and Spain, in the hands of Charles V., rapidly brought about a new state of things. Spain, Italy, and Flanders became almost like one kingdom; and new arts and a new literature began to spread over the entire united empire. It was partly through this circumstance, and partly through the commercial changes which turned the Atlantic into the great highway of trade, that the Western nations now began to enter into the glorious heritage of Italian art.

Flanders was the country where the effects of this silent revolution were first seen. Already during the middle ages a certain careful and painstaking style of pictorial art had arisen in the Low Countries, suitable to the solid, slow, and deliberate habits of that branch of the Teutonic race. Among the wealthy burghers of Antwerp, Ghent, and Brussels—the Liverpool and Manchesters of the West—a taste for a congenial type of workmanship had naturally developed itself; and with the first flush of the Renaissance spirit it bore fruit in the earliest great Flemish painter, Quentin Matsys. Like so many other artists of his time, Matsys had been originally a handicraftsman—tradition says a blacksmith, but that is probably only a graphic way of saying that he started by being a decorative worker in metal, as Ghirlandajo and many other Italian painters also did about the same time. He was born at Antwerp, the centre of Flemish commercial life, in 1460; and his style to the last retained evident traces of the minute and patient training he had received in his original trade. His paintings are like miniatures in their detailed treatment, and they are realistic in the extreme. Matsys did not usually choose for his subject any ideal or idealised model: he took some old man or woman from the mass of common humanity around him—by preference a wrinkled and care-worn face—and reproduced it with almost startling fidelity on his panels. Such naïve treatment and careful finish exactly suited the homely class of patrons for whom he worked; and it struck the key-note of the method to be adopted by the later Dutch school. The importance of Quentin Matsys is rather that of a point in the history of the evolution of art than that of a really great master.

A century later, after being carried on by a number of lesser artists of some note, the Flemish school culminated in the person of Peter Paul Rubens. This great and powerful, but very coarse painter was born in Westphalia in 1577; but he was brought up at Antwerp, and received all his earliest artistic ideas in the Flemish city. Studying first under the local painter Van Veen, who had learnt at Rome from Zuccheri, Rubens determined to complete his artistic training in Italy, where he was deeply influenced by the works of Titian. Indeed, all the art of the period may be affiliated more or less directly upon the Venetian school. He also visited Spain, one among the many proofs how much the imperial connection was binding all Europe together into a continuous whole. Returning to Antwerp, Rubens became painter by appointment to the Archduke Albert, the stern Spanish Governor of the Provinces; and later on he went to Paris, where, by order of Marie de Medici, he painted the great, but disappointing, series of works representing the life of Henri IV. of France, now in the gallery of the Louvre. These well-known pictures represent Rubens at his worst; they consist for the most part of large and coarse figures—the women especially being large and vulgar-looking in the extreme—boldly and vigorously painted in an effective

broad style. Animalism is the great fault of Rubens's work: he represents the strong homely Flemish nature somewhat corrupted rather than refined by sensuous Italian influences. Meeting the Duke of Buckingham in Paris, Rubens was induced to visit England, and was knighted by Charles I., for whom he painted some of his best-known pictures. Rubens had a rapid, dashing style, and worked with almost careless haste; but his wonderful power of hand still kept his work from ever degenerating into anything slipshod. His merits are all those of execution, his defects those of taste and character. He was a coarse-minded man, but a great painter. His famous "Descent from the Cross" at Antwerp shows his workmanship perhaps at its best, though even this, with all its power, is singularly wanting in the tenderness and pathos which we expect in the treatment of such a solemn subject.

Vandyck, a pupil of Rubens, born at Antwerp in 1599, was the last great painter of the Flemish school. Like his master, he visited Italy, and studied colouring from the works of Titian. He devoted himself entirely to portrait painting, and he far surpasses in this department any other of the great masters, except perhaps Titian himself, and possibly Rembrandt. Charles I. was the earliest English king who effectively patronised the fine arts, and he invited Vandyck, as he had invited Rubens, to his court. Vandyck's best portraits are those of Charles I. himself and his children, and all his greatest works are still preserved in England—a point which marks the gradual westward advance of the artistic spirit, for up to the seventeenth century England was a mere cypher in art. His style accords well with that of the Court which he served; there is in it much of the grace, the delicacy, and the hauteur of the Cavaliers and their ladies, and the costume of the time is indeed most familiar to us as handed down in his pictures. Vandyck died in London in 1641.

The Spanish school is closely connected with the Flemish on the one hand, and with the Roman on the other. Even before the intimate intercourse between Italy and Spain, brought about by the common sovereignty of Charles V., a succession of native artists had arisen in the Peninsula, whose works, however, are very little known beyond the Pyrenees. But under the great Castilian and Austrian dynasty, the influence of Italian art naturally spread into Spain. Velasquez, the earliest Spanish painter whose works have obtained any great note outside the Peninsula itself, was born at Seville in 1599, the same year as Vandyck, and studied at first under local masters. The influence of the Moorish tone is strong in his works, as in all those of the Spanish school; it throws over his painting a certain subtle kind of sense for colour, which is wanting to most northern artists. Invited to Madrid, then almost a foreign city for a Seville man, he executed portraits of Philip IV. and his suite, and became painter by appointment to the Court. He next visited Italy, having previously become acquainted with Rubens at Madrid; and while there he spent a year at Rome, studying the great works of Raffael and Michel Angelo, in the Vatican and the Sistine Chapel, besides going to Naples and elsewhere. No painter was ever more universal in his choice of subjects than Velasquez. He excelled especially in portraits; but he was also fond of animal painting, and his landscapes and historical pieces are almost equally good in their way. Unfortunately, in order to see Velasquez at his best it is necessary to visit Madrid, as very few of his pictures have ever left the Spanish galleries. We have a few examples in England, however, amongst them three in the National Gallery. Velasquez died in 1660.

The Spanish school finally culminated in the person of Bartolomeo Esteban Murillo. Like Velasquez, Murillo (1618-1682) was born under the shadow of the great cathedral of Seville, and brought up among the semi-Moorish architecture of the southern city. He came, as so often happens, of a family of painters, and received his first artistic education in the studio of his uncle. In his youth he went to the capital, and there was encouraged by Velasquez, whose pupil he became. Later on in life he returned to Seville, where he worked till his death. Murillo's work is the most intensely Spanish and individualist of any Peninsular painter's. He had great delicacy of touch and a certain air of inspiration which cannot fail to touch the beholder. The intense faith and strong idealism of the Spanish nature speak out in every line. His treatment of colour was remarkably mellow and harmonious, and his devotional works

have a kind of indescribable elevation which raises them almost above the reach of criticism. His paintings have travelled outside Spain far more than is the case with those of Velasquez. Among the most celebrated are the "Assumption of the Virgin," and the "Immaculate Conception," now in the Louvre, and the "Prodigal Son," at Stafford House. A considerable number of his works are to be found in England; the National Gallery

With him the Spanish school sank into comparative insignificance. The momentary connection with the Empire had brought Spain for a while out of its normal isolation behind the Pyrenees, and the wealth of the new world had roused fresh life for a century in the decaying kingdom. But she soon relapsed when left to herself, and sank in art, as she sank in literature, science, and philosophy. The age of Cervantes and



THE VIRGIN AND CHILD. (By Murillo.)

possesses three, including the "Holy Family," one of his best examples. Some of his pictures are taken from the common low life of Madrid or Seville, treated, however, in a peculiar lofty style, which deprives them of all their grossness. Such is the magnificent "Beggar Boy," in the Louvre, a figure which no artist except Murillo would ever have ventured to choose for a model, but which his singular powers of treatment have made into a wonderful picture. While painting a "St. Catherine" in the Capuchin church at Cadiz, Murillo fell from the scaffolding, and died from the effects of his injuries.

Lopo de la Vega, of Velasquez and Murillo, was the only age when Spain ever contributed anything to the general elements of life and progress in Europe. As in every other case, the period of artistic greatness coincides in Spain with the period of commercial, political, and literary greatness. When the general life of the country sank to the dull round of Spanish thought and Spanish interests, the artistic movement sank with it. It was in the living and progressive northern countries—in England, France, Holland, and Germany—that art was henceforth to make her greatest advances.

VOCABULARY

Liebe Nina, antwortete die Mutter, du hast kein ja
Lee-bai lee'-nah, ant'-vör-tai-tai deo möö'-ter, doo hast zine yah
förgfältig gepflegt. Ach nein, erweiterte das Kind, ich habe
zör'-fol-ti-y gai-pfley't. Ach niae, err-vee'-der-tai dass kint, ty hah'-hu
noch kurz vor seinem Tode ein Stüchchen Zucker, das du
noch köörts fore zi-nem to'-dae shtück'-yen tsöök'-ker, dass doo
mir für dasselbe gabst, ihm nicht gebast, sondern selbst
moer fu'r dass-zel-bai gahpst, eem nüt gal-bracht', zön'-dern zelpst
gegessen. So sprach das Mädchen mit betrübtem Herzen.
gai-ghess'-sen. Zo shprach dass meyt'-yen mit bai-trü'-p'nen herr'-tsen.
Die Mutter aber lächelte nicht über die Klagen des
Dee möö'-ter ah'-ber ley'-yel-tai nüt a'-ber deo klah'-ghen dees
Mädchens, denn sie erkannte wohl und verehrte die heilige
meyt'-yens, den zee er-kan'-tai wohl ööat ferr-ey'-tai deo hi'-l-gai
Stimme der Mutter in dem Herzen des Kindes. Ach!
shim'-mai dair na-toor' in daim herr'-tsen dess kin'-des. Ach!
sagte sie, wie mag dem unanfahren Kinte zu Muth
zahy'-tai zee, vee mahy' daim ön'-dank-bah-ren kin'-dai tsöo möo'-tai
sein am Grabe der Eltern.
zine am grai'-bai dair el'-tern.

Gancricn, canary (not
used alone).
Bogelchen, n. little
bird.
Name, n. name.
Allerliebſt, moſt lovely.
Ziingchen, n. little
creature.
Ven, of, from.
Früh, early.
Morgen, m. morn-
ing.
Bis, till.
Abend, m. evening.
Schön, beautiful.
Weiß, yellow.
Mit, with.
Schwarz, black.
Haarſtück, n. tuft
(Haute, f. cap).
Geben, to give.
Ihm, to him (it).
Du, to.
Eſſen, to eat.
Saamen, m. ſeed.
Kühlen, to cool.
Kraut, n. herb.
Zuweilen, ſometimes.
Stück, n. piece.
Zucker, m. ſugar.
Ziſch, fresh.
Waſſer, n. water.
Plötzlich, ſuddenly.
Trauern, to grieve,
mourn.
Siegen, to lie.
Tott, dead.
Käfig, m. cage.

Erheben, to raise, l
up.
laut, aloud.
Wehklagen, *n.* lamen
nation; *v. n.*
lament (lame
complaint, lame
Weh, *n.* weep).
Weinen, to weep.
Um, for, about,
round.
Kaufen, to buy.
Ander, other.
Nisch, yet, still.
Farbe, *f.* colour, dy
paint.
Gen so, just so.
Jener, jene, jenes, tha
Ihnen, to put, to do
Allein, but, alone.
Neu, new.
Sich rühmen, to wa
der.
Lieb, dear.
Du bist, thou art.
Betrübt, sad (betrüb
to afflict).
Dein, thy.
Thräne, *f.* tear.
Hufen, to call.
Werden, to become
sign of the futu
tense, shall, will
sign of the passi
voice, to be, to
doing.
Sterben, to die.
Leben, *n.* life.

Schlecht, schlechter, bad,
 worse.
 Ach, oh, alas.
 Sankeln, to act.
 Unrecht, wrong.
 In, *prefix*, un-, not.
 Was, what.
 Sollen, to be obliged,
 shall.
 Sein, *seiner*, *genitive*,
 of it, of him.
 Sorgfältig, carefully.
 Nein, no.
 Gernsten, to reply.
 Kurz, short, -ly.
 Tod, m. death.
 Was, *dative*, to me.
 Gut, for.
 Dasselbe, the same.
 Sener, but.
 Selbst, myself, your-
 self, etc.
 Herz, n. heart.
 Lächeln, to smile.
 Über, at, over.
 Erkennen, to recognise.
 Wohl, indeed, well.
 Verehren, to honour
 (Ehre, f. honour).
 Stimme, f. voice.
 Mögen, may.
 Zu Muth sein, feel.
 (Muth, m. courage,
 mind).
 Danbar, grateful
 (-bar, *affix*, produc-
 tive of, able).
 Grab, n. grave.

KEY TO EXERCISES IN LESSONS IN GERMAN.

EXERCISE 91. (Vol. II., page 63).

1. Amerika hat einen goldenen Voten für denjenigen, welcher eines Handwerks kundig ist. 2. Der Geizige ist unempfindlich gegen das Elend Anderer. • 3. Die Italiener, welche sich in einigen Provinzen gegen österreichische Unterdrückung erhoben, waren uneigentlich ihrer Schwärze. 4. Ich wurde des Hörens einer so langen Rede müde. 5. Jeder Mensch ist seines Todes gewiß, aber Niemand ist stets desselben eingedenk. 6. Wenn du des Landlebens so gewohnt wärest wie ich, würdest du nicht in der Stadt leben. 7. Niemals will ich mich einer That schuldig machen, welche mich Ihrer Freundschaft unwürdig macht. 8. Der Mensch, welcher ein gewissenhaftes Leben geführt hat, und den Befehlen seines Gewissens gefolgt ist, fürchtet den Tod nicht; doch der Böse, uneingedenk seiner Thaten, und bewußt seiner Verbrechen, fürchtet den Tod und die Zukunft. 9. Mancher der eines Verbrechens angeklagt vor seinen Richtern steht, ist sich einer kleinen Schuld bewußt, als die, welche ihn richten.

EXERCISE 92 (Vol. II., page 63).

1. It would be agreeable to me if I could find a man who was attached to me. 2. Even if you are related to me, yet your behaviour does not seem to me at all becoming; and I should think you yourself might perceive that people to whom your behaviour is known are not favourable to you. 3. My father remembers the last death very well. 4. That path is dangerous to the wanderer. 5. Be obliging to thy neighbour, obedient to thy superiors, then will they be well disposed, and he be favourable to you. 6. Is the money promised to you certain? 7. As the prince is not like-minded with the people, and the people are in different to the prince, it makes governing difficult to the former, and hinders the prosperity of the latter. 8. The stars are favourable to me; my undertaking will be easy to me. 9. If bugs are not injurious to men, yet they are troublesome to them. 10. I am very glad that I can be useful to you in this affair. 11. Your praise was very flattering to my friend. 12. To become good is difficult to the vicious, because they generally remain true to their inclinations. 13. Many a weak man is superior in mind to the strong man. 14. What difference is there between saying, "One man is unlike to the other," and "One man is dissimilar to the other"? 15. How stands the game? 16. Very unfavourably to me. 17. Though it is disagreeable to me, I must declare to you that your talk is insufferable to me. 18. Who likes to admit

LESSONS IN CHEMISTRY.—XVI.

SELENIUM-TELLURIUM-PHOSPHORUS.

SELENIUM.—SYMBOL, SE—COMBINING WEIGHT, 79.5—DENSITY, 79.5. THIS rare element was discovered by Berzelius in the refuse of a sulphuric acid manufactory, at Fahlun, in Sweden. It is not found free in nature, and the source from which it is usually obtained is the mineral *claussthalite*, in which it is combined with lead—although the selenides of iron, copper, and silver are the most abundant.

Preparation.—Some clausthalite is reduced to a fine powder and fused with three times its weight of saltpetre, by this means the selenide (PbSe) becomes selenate (PbSeO₄). The mass is now digested in water, acidulated with a little hydrochloric acid to neutralise any of the alkali of the nitre which may remain, and the liquid evaporated down to a small bulk. A current of sulphurous acid throws down the reduced selenium as a red, flocculent, amorphous powder, the sulphurous acid becoming sulphuric.

Properties.—It is chiefly remarkable for its close resemblance to sulphur. It may be obtained, like that element, in the three forms—amorphous, vitreous, and crystalline. When the powder of the precipitate above alluded to is dried, and submitted to a temperature a little below that of boiling water, it begins to soften, and a few degrees higher it melts; upon cooling, it forms a brittle solid, with a glassy fracture. Its colour is deep brown; it possesses neither taste nor smell; is insoluble in water, and refuses to conduct either heat or electricity: and yet its lustre is metallic. Sulphuric acid is capable of dissolving it, and is rendered green; but when diluted the selenium falls unaltered. Bisulphide of carbon, at its boiling point, can hold in solution 1 per cent. of this element, and upon evaporation the selenium

is deposited in crystals. In this form its specific gravity is 4.5, whereas in the vitreous state it was 4.7.

A third modification, corresponding to the viscid state of sulphur, is obtained by sustaining the temperature of the selenium at 90°C. for some hours: it then suddenly rises to 160°C. If it now be cooled, its specific gravity is found to be 4·8, its fracture has become granular, like cast iron, and its colour changed to bluish-grey. When thrown upon a hot coal reddish vapours are given off, which are characterised by their peculiar smell—that of horseradish. It burns in the air with a bright blue flame, and two well-defined oxides—selenic dioxide (SeO_2) and selenic trioxide (SeO_3)—are known.

Selenic dioxide, or Selenious Acid (SeO_2 ; combining weight, 111.5), is usually prepared by oxidising selenium by means of nitric acid. The excess of the nitric acid is expelled by heat, and the white selenious anhydride remains. At a temperature near low red heat it will sublime in a yellow vapour, which on condensing forms beautiful white acicular (needle-like) crystals. These are deliquescent—that is, they absorb moisture from the atmosphere—becoming selenous acid, which forms with bases the class of salts called selenites, which are all recognised by emitting the horseradish odour, when heated on charcoal in the blowpipe flame.

Selenic Acid (H_2SeO_4).—This acid is produced if, in the process which has been given for procuring selenium, sulphuretted hydrogen be used, instead of sulphurous acid. Thus—

By filtering, the lead sulphide is separated; and by evaporating the liquid until its specific gravity is 2.6, selenic acid is obtained. When heated this acid gives off oxygen, and becomes selenous acid; it forms with bases selenates, which are *isomorphous* with their corresponding sulphates, that is, they crystallise in the same form.

Seleniuretted Hydrogen (symbol, H_2Se ; combining weight, 81.5; density, 40.75).—This gas is obtained exactly as sulphuretted hydrogen, that is, by the action of an acid on a selenide. Its odour is even more offensive than that of its sulphur correspondent.

TELLURIUM:—SYMBOL, Te —COMBINING WEIGHT, 129—DENSITY, 129.

The classes of every natural kingdom seem to gradate into each other. That is, between every great division we find individuals which partake of the characteristics of each class. Tellurium occupies this position between the metals and metalloids, whilst, from its rather high specific gravity, 6.5, some chemists are inclined to rank it with the metals; yet, from its close analogy to selenium and sulphur, others prefer to consider it as a metalloid. It is a rare substance, sometimes found native in the mines of Hungary and Transylvania, but generally it is combined with gold, silver, bismuth, or copper. It possesses a high metallic lustre, and resembles bismuth in appearance. A high temperature converts it into a yellow vapour, which condenses in drops and flexible needles; it is a feeble conductor of heat and electricity. When strongly heated in the air it takes fire, and burns with a blue flame, edged with green, into

Tellurous Dioxide (TeO_2), which with water forms tellurous acid (H_2TeO_3). Its acid properties are feeble, and it possesses a bitter metallic taste.

Telluric Acid (H_2TeO_4) is the combination of telluric trioxide and water. This trioxide is produced when the element, or a tellurite, is heated with saltpetre. The process is similar to that by which selenic acid was procured.

Telluretted Hydrogen (H_2Te) is procured by the action of hydrochloric acid on an alloy of tellurium with zinc or tin. It is a colourless gas, having the same smell as sulphuretted hydrogen. It acts upon solutions of metallic salts similarly to that gas, precipitating their tellurides.

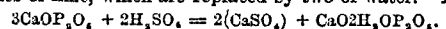
It is usual to group oxygen, sulphur, selenium, and tellurium together, since they each unite with two atoms of hydrogen. The last three elements, as in the case of the three halogens, exhibit a remarkable gradation, their combining weights, their specific gravities, their melting and boiling points, being almost in arithmetical progression—that is, in everything selenium is a mean between sulphur and tellurium.

PHOSPHORUS.—SYMBOL, P.—COMBINING WEIGHT, 31—DENSITY, 62.

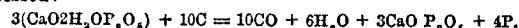
The density of the vapour of phosphorus is an exception to the rule hitherto strictly regarded, for, instead of being the same as its atomic weight, it is just double, or 62, and therefore the volume occupied by an atom of phosphorus is only

$\frac{1}{2}$, that of the preceding elements being 1. The great affinity phosphorus exhibits for oxygen precludes the possibility of its being found free in nature. It chiefly exists in combination with lime, as phosphate of lime (calcium phosphate, $\text{Ca}_3\text{P}_2\text{O}_8$), which is found in bones, and in the seeds of plants. The origin of calcium phosphate is traced to a constituent of some of the granitic rocks—the mineral apatite—from the disintegration of which the soil has become possessed of this necessary ingredient of all seed-producing soils.

Preparation.—Bone earth—which is obtained by calcining bones—is composed of $\frac{2}{3}$ phosphate of lime and $\frac{1}{3}$ carbonate of lime; this is treated with diluted sulphuric acid, and kept at 100°C for twenty-four hours. By this means all the carbonate of lime becomes sulphate, and the phosphate is deprived of two molecules of lime, which are replaced by two of water. Thus—



This last salt is called the *superphosphate of lime*. Being soluble it is easily separated from the calcium sulphate. Evaporating down the solution to a syrup, a quarter of its weight of charcoal is added, and the whole transferred to an iron retort. The neck of the retort dips into water. On applying heat, bubbles of carbonic oxide escape, and phosphorus, as a yellow wax-like substance, distills into the water, the reaction being thus expressed:



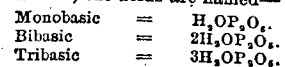
Properties.—It is sold in sticks, which are clear and colourless when the substance is new. Its specific gravity is 1.83. It oxidises at all temperatures above 0°C , emitting a faint "phosphorescent" light, giving off white fumes, which are phosphoric acid (P_2O_5). It melts at 45°C , and boils at 290°C . It is extremely inflammable, and must be handled with the greatest care, as much under water as possible. Carbonic disulphide dissolves it readily: from this solution it can be obtained in crystals. When heated in an atmosphere of H_2 or CO_2 , to a temperature of 240°C , it assumes its "amorphous" condition, which is a dark red powder. This is more easily made by melting the phosphorus with a trace of iodine. In this condition it is not nearly so inflammable, need not be kept under water, and is not soluble in carbonic disulphide.

Matches.—The great use of phosphorus is in the manufacture of lucifer matches. The ordinary ones are composed of a mixture of phosphorus, potassium chlorate, glue, and red lead; the stick is first dipped in paraffin, and then into the above paste.

Bryant and May's safety matches, which strike only on the lid, are made of sulphide of antimony, potassium chlorate, and powdered glass. The lid is smeared with red amorphous phosphorus, and ignition only takes place when the potassium chlorate and phosphorus are rubbed together. By using the above mixture, it is found unnecessary to dip the stick in paraffin, as it will catch fire from the ignited composition. This action of phosphorus and potassium chlorate may be shown by powdering a few grains of the salt, adding a piece of red phosphorus about the size of a pea, then very carefully folding it up in paper; upon striking it a moderate blow with a stick, a somewhat violent explosion will ensue. Phosphorus is poisonous; it has a singular action on the jaw-bone, which decays away; this is said not to be the case with the amorphous variety.

Phosphoric Anhydride (symbol, P_2O_5) is a white powder, formed when phosphorus is burnt in oxygen, or dry air. It is very deliquescent, combining with three atoms of water, forming the hydrated acid ($3\text{H}_2\text{OP}_2\text{O}_8$), which may be considered as two molecules of H_3PO_4 .

Phosphoric Acid.—The anhydride is capable of forming three acids, by taking three different proportions of water. Considering the water as a base, the acids are named—



Sometimes the first is called "metaphosphoric acid," and the second "pyrophosphoric acid," because it is got from the third by heat.

The *Monobasic* is obtained by evaporating dilute phosphoric acid to a syrup, and subjecting this to a low red heat.

The *Tribasic* is procured by boiling for twenty minutes a solution in water of "glacial phosphoric acid." This latter is formed when the hydrate ($2\text{H}_2\text{OP}_2\text{O}_8$) is exposed to a red heat in a platinum dish. The tribasic acid may be got in a crystalline

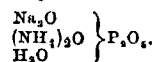
form by evaporating its solution. If, now, these crystals be melted by heat, and the temperature maintained for some time at 212°C , one atom of the basic water will be expelled, and the *bibasic acid* remains. These three kinds may, when in solution, be thus distinguished—

The monobasic is the only one which will precipitate a solution of albumen.

The bibasic gives a white precipitate with nitrate of silver.

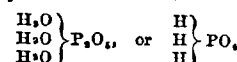
The tribasic a yellow precipitate with the same salt.

By replacing the atoms of water in these acids by various bases, corresponding salts may be obtained. Sometimes the water atoms are replaced by different bases. Thus—

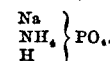


is *microcosmic salt*, which is much used with the blowpipe.

This process may be thus exhibited—



Now replace one of the H by its equivalent of Na, and another by its equivalent (NH_4) ammonium, so that we have



Phosphorous Acid (P_2O_3) is obtained by burning phosphorus in a limited supply of air. It is bibasic, forming phosphites. When raised to a high heat it is resolved into phosphoric acid, and the gas next to be considered.



Phosphuretted Hydrogen (PH_3).—When a few pieces of phosphorus are heated in a strong solution of potash, bubbles of this gas are emitted, which, as they rise from the water into which the delivery tube is dipped, take fire. As the combustion is simultaneous at all points of bubble, a ring of white vapour of phosphoric acid is formed. This very beautiful experiment is

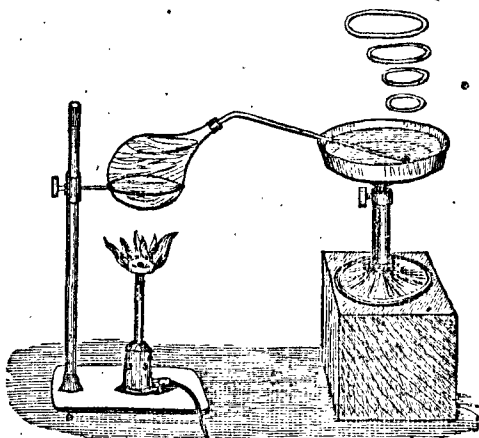


Fig. 48.

arranged as in Fig. 48. The flask must be nearly full of the solution.

Phosphuretted hydrogen is not spontaneously inflammable when pure, but this property is due to the presence of a minute quantity of a liquid, whose composition is supposed to be PH_4 . It is this gas which sets fire to the bubble of marsh gas, forming the ignis fatuus.

Phosphorous Chloride (PCl_3).—Clear phosphorus burns with a pale blue flame in dry chlorine, forming this compound. It is capable of decomposing water and other oxides, the chlorine combining with the hydrogen, or the metal and the phosphorus forming a phosphite (H_3PO_3).

Phosphoric Chloride (PCl_5) is produced by a further action of chlorine on phosphorous chloride. With bromine two similar compounds are formed; with iodine the beautiful crystalline P_2I_4 , and with sulphur three well characterised sulphides— P_2S_2 , P_2S_3 , P_2S_4 —are produced.

RECREATIVE NATURAL HISTORY.

THE HOUSE-FLY.

As the family of insects to which the house-fly belongs (*Muscidae*) contains above one hundred species, we must limit our attention, in this paper, to that buzzing and teasing creature which so often worries us during the sultry days of summer.

The common house-fly (*Musca domestica*) may seem too well known to require any description. But there are many who will find, on examination, something to wonder at in this dipterous* insect. The wings and power of flight claim our consideration first. Those who closely watch will often be surprised at the manner in which the fly moves through the air with its back downwards. Of course when the insect darts from a table to the ceiling it must perform a kind of somersault in the air. The feet, which were downwards on the table, must be turned uppermost to grasp the ceiling. The motion is so rapid and so unexpected that not one case in a thousand may attract our notice. A keen watchfulness will also enable us to observe that this insect can fly forwards or backwards with, apparently, equal ease. The rate of its motion is about twenty miles an hour, so that a fly can compete, for some time at least, with an ordinary railway train. Some may here ask whether the "buzz" of the fly is produced by the rapid vibration of the wings against the air. This may, in some cases, be the cause of so peculiar a sound, but no decisive answer can, with our present knowledge, be given to the question. The fly is rightly called a two-winged insect, but the rudiments of a second pair can be easily seen, just behind the true wings. These singular organs are called *poisers*, from a supposition that they enable the fly to balance itself during its rapid somersaults in the air. These little thread-like filaments, with the knob on the top of each, may remind some of the balancing-poles used by dancers on the tight-rope. If the common notion respecting the use of the poisers be correct, we shall readily admit that the fly is well fitted for its evolutions, possessing both a moving and balancing apparatus.

The feet of the fly have long presented a puzzling problem to naturalists, and some persons may even now doubt whether the action of these organs is yet clearly understood. The problem is to explain how the fly can suspend itself from a ceiling or walk up a smooth pane of glass. The "sucker" theory was long popular, and we believed, with little questioning, that the fly's feet were supplied with a kind of air-pump, by which a vacuum was produced under the feet, enabling them to cling to

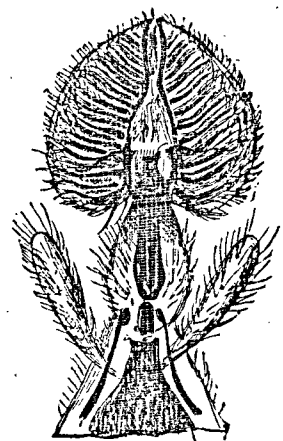
the glass much in the same manner that a boy's toy sucker adheres to a stone. Let no reader prepare himself to listen to a new theory on the subject; we must content ourselves with describing the successive views which have been advocated, and then stating that now held by those who have most closely studied these fine and complex structures. Our readers will bear in mind that very high and clear microscopic powers, great patience, and numerous observations are necessary for a satisfactory examination of such minute organs.

In 1664, Mr. Power, after long scrutiny of the fly's feet, suggested that the insect clung to surfaces by its hooked claws, and also by the aid of a fluid poured from tubes on the feet. He saw two powers at work; a gripping machine in the claws, and an adhesive action in the gummy liquid. Three years later, in 1667, the Gresham professor, mathematician, and naturalist, Dr. Robert Hooke, described in his "Micrographia" the "small bristles" on the "soles" of the fly's feet. He called them "tenters" (*holders*), and counted ten on each foot, thus giving to this small insect sixty holding instruments. But Hooke goes on to describe what he terms

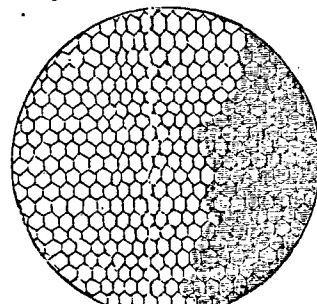


THE FOOT OF THE HOUSE-FLY (MAGNIFIED).

"a smoky substance" noted by him on glass, and which he thought aided the fly's "bristles" in clinging to so smooth a surface. Was this "smoky substance" the fluid observed by Power, or was it simply the corroded face of the glass? There is no doubt that glass does undergo a decomposition, which working opticians call "the sweating." The worn and irregular surface thus produced would aid an insect in clinging. Leuwenhoek, the patient and profound Dutch naturalist, employed his improved microscopes in examining the "bristles" detected by Dr. Hooke. Leuwenhoek saw them clearly, and thought that the end of each resembled a hook. This conjecture has been verified; the extremity of each "bristle" is curved, and so presents a hooked form. Dr. Derham, the friend of Hooke, and editor of Ray's works, turned, for a time, from his experiments on pendulums and observations on the solar spots, to investigate the structure of a fly's foot. His researches led him to adopt a notion resembling the sucker theory. He suggested that flies clung to smooth surfaces by what he vaguely calls their "skinny palms." Derham may have had in his mind the adhesive fluid of Mr. Power and the "smoky substance" of Hooke, while he himself may have indistinctly noted what are now called "the flaps" on the foot. By combining all these, Derham might have got his notion of an adhesive or "skinny palm." Gilbert White, though an acute observer of Nature, was not likely to go deeply into microscopic investigations. He therefore adopted the "sharp hooked nails" of Dr. Hooke, the "skinny palms" of Derham, and the sucker theory as explanatory of the whole matter. White, however, clearly admitted the action of two powers in the fly's foot, one for suspension, the other for producing a vacuum. Have we advanced beyond this in certainty of knowledge? Mr. John Blackwall, in 1830, described three conclusions to which he had been led. He detected an expansion at the end of each hair or "tenter," resembling a little pad or cushion, but denied the existence of any vacuum-producer or air-pump structure. Some persons reminded him that each hair, with its expanded tip, might really be a separate sucker. This conclusion he refused to admit, alleging it to be unsupported by proofs. Here, then, was a distinct



THE TRUNK OF THE HOUSE-FLY (MAGNIFIED).



THE EYE OF THE HOUSE-FLY (MAGNIFIED).

denial, by an acute microscopic observer, of the sucker theory, accompanied, however, by a clear statement that the end of each hair on the fly's foot possesses a peculiar expansion, looking as if it must have some special work to perform. Mr. Blackwall also arrived at a third conclusion—that a fly in walking along a pane of glass leaves behind certain marks, as if a fluid had been poured out at particular points. He thus agrees with the observations of Power, Hooke, Derham, and White. The examination was still carried on by naturalists, with the aid of the best microscopes. In 1841, Mr. E. Newman called attention to the almost inconceivable number of the "bristles." Hooke had estimated the whole number of the "tenters" on the six feet at sixty; Mr. Newman declares they are "almost infinite."

This observer also saw that a liquid was poured out from some part of the complex structure. This fluid has been subjected to chemical analysis, but no remarkable element has been discovered. Water and oils appear to be the constituents, so that it is similar to the ordinary matter given off by the pores of the human skin.

Mr. Hepworth, in 1854, observed that "the flaps" of the fly's feet were trumpet-shaped, or resembling the form of a boy's sucker when supporting a heavy stone. This gentleman also

* Diptera, a Greek word signifying "two wings."

noticed the marks left on glass by "the flaps," but denied the existence of an adhesive fluid in sufficient quantity to support the weight of a fly. He advocated the sucker theory, giving no less than 12,000 suction tubes on one foot of a common fly. If this statement should stand the test of examinations, we shall then have in one small insect 72,000 suction machines. It may give some readers a clearer view of the minute scrutinies now made into insect structure when we state that the expanded edge of a fly's foot, called "the flap," has been found to be only $\frac{1}{1000}$ th of an inch in thickness.

Mr. Tyrrell and Mr. West have devoted much time to the examination of these "flaps," and the following are the principal results:—Two distinct sets of hairs are found on the foot of a fly; one, called "tenents," rise from the inner side of the flap, and are employed to grip smooth surfaces; the other series are called "guard hairs," their office being to protect the fine hooked tips of the "tenents" from injury by friction. We must observe here that house-flies are not the only insects furnished with such a double system of hairs—most beetles are similarly supplied.

The fly's apparatus for walking and holding on may be thus summed up:—On a rough surface the insect appears to use its claws only; on glass, or on a ceiling, three processes are brought into action—first, the "almost infinite" number of hairs are pressed down on the smooth surface; a peculiar movement of the bristles then expels all the air from between or beneath the hair-like cushion; lastly, a fluid is poured out round the base of the entire hair-pad, and the expelled air is thus prevented from entering. A vacuum is in this manner secured and maintained so long as may be necessary. When the fly wishes to move, the flap, firmly pressed down on the glass, must be first raised, and this is accomplished by the hooked claws which lift up the thin edges of the hair-pad, and thus let in the air and destroy the vacuum. The movement of the claws in this process is very peculiar. Some notion of it may thus be gained:—Let a reader suppose that a sucker is fixed to the tip of his little finger, and that this sucker becomes fastened to a table by atmospheric pressure; let him also imagine the tip of his thumb to be armed with a number of fine hooks. He will be able to lift the edges of the little finger sucker by these thumb hooks, and thus the air will be admitted under the sucker. Somewhat after this fashion does the fly loosen its foot from a surface of glass.

The insect requires all its force thus to move the feet nimbly. When benumbed by cold or weakened by other causes, the fly remains fixed to one place, unable to lift its feet from the surface. Feeble or diseased flies may sometimes be seen violently struggling to extricate themselves. This was observed by White, who describes the insects as "labouring along and lugging their feet in windows, as if they stuck fast to the glass." Mr. West has endeavoured to estimate the exact amount of the forces which enable a fly to adhere to glass. He found that one-half the insect's weight is supported by the atmospheric pressure on the feet when the vacuum has been produced. One-fourth of the weight is upheld by the grip of the "tenent" hairs, and the remaining fourth part by the fluid emitted from the flaps. As a common house-fly weighs about half a grain, the supporting force exerted by each of the six feet will amount to one-twelfth of a grain only, and this force is distributed among three powers—the atmospheric pressure, the "tenent" hairs, and the sustaining fluid. Each of these forces would have to support the $\frac{1}{3}$ th of a grain only, assuming the weight to be equally distributed throughout.

We have devoted thus much of this paper to the investigations of eminent men into the structure of a fly's foot, with two objects in view—to induce some readers to make a more constant use of the microscope in their studies, and to deepen the conviction that there is nothing really little in the works of an infinite mind.

The antennæ of the fly, or feelers, as some call them, must not detain us long, but we cannot pass over some peculiarities of structure in these organs. The third point in the antennæ of the blue-bottle fly (*Musca vomitoria*) is pierced with exceedingly fine apertures, the diameter of each being only $\frac{1}{1000}$ th of an inch. So numerous are these openings that both antennæ are estimated to contain 17,000. The mouth of each tube is protected by a fine curtain-like membrane, behind which a minute sac full of fluid can be seen. Some naturalists regard this singular system of apertures and sacs as forming the ear

of the fly. This can, however, only rank at present as a clever supposition, which subsequent discoveries may prove to be true.

The proboscis or trunk of the fly consists of many suction tubes, admirably fitted for pumping up the fluids on which the insect feeds. This trunk would admit of a much longer description than our space allows; we must, however, remind the reader that a fly's proboscis really contains tongue, jaws, and lips, all modified and combined in one organ. The tongue is a net-work of fine tubes; two fine hooks are visible near the tip, one on each side, and the extremity is furnished with a series of most delicate vessels, through which the food passes up to the more fleshy parts of the tongue. An elaborate system of exceedingly minute muscles draws out and retracts the tongue, and aids in rolling up the whole trunk when the insect has finished its meal. As nothing but a fluid can ascend the fine tubes, it might be supposed that no fly could dine off a solid lump of sugar. But the insect is able to dissolve such a substance by a liquid poured from the trunk, and thus the liquefied sugar is easily drawn up the suction vessels.

The eyes of a fly are very large when compared with the size of the head. If one of these compound eyes be examined under a glass with a linear magnifying power of 100, the organ will be found to consist of many thousand tubes, each fixed in a six-sided case. Every one of these eyelets appears to be a perfect simple eye, resembling in all essentials that of man. Dr. Hooke gave the number of eyelets in each eye at 7,000, and Dr. Carpenter estimates them at 4,000. Thus, at the lowest computation, a house-fly possesses 8,000 separate organs of vision.

Few insects seem to lead a happier life than this nimble little creature. But its days are not always free from trouble; a disease of a peculiar character attacks the fly, producing a white eruption on the body, suggesting the idea of insect leprosy. The fly is also infested by little parasitic animals, which some enthusiastic naturalists have carefully figured and described.

Many persons may ask, what special service do flies perform in the system of Nature? Their particular office appears to be the rapid consumption of those dead and minute animals whose decaying myriads would, otherwise, soon poison the air. It was a remark of Linnaeus, that three flies would consume a dead horse sooner than a lion could. He, doubtless, included the families of the three flies, then he was certainly right. "A single fly will sometimes produce 20,000 larvæ, each of which in a few days may be the parent of another 20,000, and thus the descendants of three flies would soon devour an animal much larger than a horse."

Our readers will see, in the preceding remarks, that even a common house-fly can offer to a student of Nature many marvels of structure, and numerous proofs of an infinite intelligence in the almost invisible organs of the meanest creatures.

READINGS IN FRENCH.—II.

LE SAPEUR DE DIX ANS.

SECTION V.

À PARTIR de ce jour, on ne se moqua (a) plus autant du petit Bilboquet,¹ mais il n'en devint (b) pas pour cela plus communicatif; au contraire, il semblait rouler dans sa tête quelque fameux projet, et, au lieu de (c) dépenser son argent avec ses camarades, comme ceux-ci s'y attendaient, il le serrait soigneusement.²

Quelque temps après, les troupes françaises entrèrent à Smolensk,³ victorieuses et pleines d'ardeur; Bilboquet en était, et le jour même de l'arrivée, il alla se promener (d) dans la ville,⁴ paraissant très-content de presque tous les visages qu'il rencontrait;⁵ il les considérait d'un air riant⁶ et semblait les examiner comme un amateur qui choisit des marchandise. Il faut (e) vous dire cependant, qu'il ne regardait ainsi que les paysans qui portaient (f) de grandes barbes.⁷ Elles étaient sans doute très-longues et très-fourmies (g), mais d'un roux si laid, qu'après un moment d'examen Bilboquet tournait la tête et allait plus loin. Enfin, en allant ainsi, notre tambour arriva au quartier des Juifs.⁸ Les Juifs à Smolensk, comme dans toute la Pologne et la Russie, vendent toutes sortes d'objets⁹ et ont un quartier particulier.¹⁰ Dès que Bilboquet y (h) fut entré, ce fut pour lui un véritable ravissement:¹¹ imaginez-vous les plus belles barbes du monde, noires comme de l'ébène;¹² car la nation juive toute dispersée qu'elle est, parmi les autres

nations, a gardé la teinte brune de sa peau et le noir éclat de ses cheveux.¹³ Voilà donc notre Bilboquet enchanté. Enfin il se décide, et entre dans une petite boutique¹⁴ où se trouvait un marchand magnifiquement barbu.¹⁵ Le marchand s'approche de notre ami et lui demande humblement en mauvais français—

"Que voulez-vous, mon petit Monsieur?"¹⁶

"Je veux (i) ta barbe," répondit cavalièrement Bilboquet.¹⁷

"Ma barbe!" dit le marchand stupéfait; "vous voulez (j) rire?"¹⁸

"Je te dis, vaincu, que je veux ta barbe," reprend le vainqueur superbe en posant la main sur son sabre; "mais ne crois pas que je veuille (k) te la voler:¹⁹ tiens, (l) voilà un napoléon, tu me rendras mon reste"²⁰ (m).

COLLOQUIAL EXERCISE.

- À partir de ce jour, comment traita-t-on notre héros?
- Que fit-il de son argent?
- Que firent les troupes françaises quelque temps après?
- Que fit le petit tambour le jour de son arrivée?
- De quoi paraissait-il content?
- De quelle manière considérait-il le visage des habitants?
- Quelles personnes regardait-il particulièrement?
- Enfin où arriva-t-il?
- Que vendent les Juifs à Smolensk?
- N'ont-ils pas un quartier particulier?
- Dès que Bilboquet y fut entré, qu'éprouva-t-il?
- Quelle était la couleur de leurs barbes?
- Quelle est la teinte qu'a gardée la nation juive?
- Quand il eut décidé, que fit-il?
- Qui s'y trouvait-il?
- Qui lui dit le marchand?
- Que lui répondit le petit tambour?
- Que lui répondit le marchand?
- Quelle fut la réponse du petit tambour?

NOTES.

- They did not laugh any more.
- From becoming.
- At the place, instead of.
- He went to take a walk.
- He must tell you.
- From porter.
- Thick, bushy.
- Y, there.
- I want.
- You would like, you are joking.
- Je venille, subj., from vouloir.
- Tiends, take, here.
- Mon reste, my change.

SECTION VI.

Le pauvre marchand voulut faire entendre (a) raison¹ au petit Bilboquet, mais il était entêté comme un cheval aveugle,² et il s'engagea (b) une dispute qui attira bientôt quelques soldats. Ils entrèrent pour s'informer du motif de la querelle, et ils trouvèrent l'idée du tambour si drôle,³ qu'ils obligèrent le pauvre Juif à lui céder sa barbe,⁴ et l'un d'eux, Gascon et le tambour du régiment, tira des rasoirs de sa poche, se mit (c) à raser le malheureux marchand⁵ et remit (d) solennellement le tout à Bilboquet qui l'emporta (e) en triomphe.⁶ En arrivant au régiment, il la fit (f) couder par le tailleur sur un morceau de peau d'un tambour crevé,⁷ et sans rien dire de son dessein, il la mit au fond de son sac.⁸ On en causa (g) pendant quelques jours,⁹ mais il fallut (h) bientôt penser à autre chose. On se remit en (i) marche, et on ne pensait plus au petit Bilboquet, quand on arriva à Moscou.

Alors il arriva d'affreux malheurs, le froid et la dévastation privèrent l'armée française de toutes ses ressources,¹⁰ la famine l'atteignit (j), et bientôt il fallut se retirer à travers un pays désert et des neiges sans fin.¹¹ Je ne veux pas vous faire un tableau de cet horrible désastre; c'est une chose trop vaste et trop épouvantable¹² à la fois, pour que je vous en parle dans cette histoire; qu'il (k) vous suffise (l) de savoir que chacun se retournait comme il pouvait,¹³ et que c'est à peine s'il (m) restait quelques régiments réunis en corps d'armée et obéissant (n) aux généraux. Celui de Bilboquet était de ce nombre. Il était de l'arrière-garde,¹⁴ qui empêchait des milliers de Cosaques, qui suivaient la retraite de l'armée,¹⁵ de massacrer les malheureux soldats isolés.

Un jour, ils venaient de (o) franchir une petite rivière, et, pour retarder la poursuite des ennemis, on avait essayé de faire sauter (p) deux arches d'un pont de bois qu'on venait de traverser;¹⁶ mais les tonneaux de poudre avaient été posés si précipitamment,¹⁷ que l'explosion ne produisit (q) que peu d'effet: les arches furent cependant démantibulées, mais toute la charpente appuyait encore sur une grosse poutre qui la (r) retenait,¹⁸ et qui, si les ennemis fussent arrivés, eût bientôt permis de reconstruire le pont.¹⁹

COLLOQUIAL EXERCISE.

- Le marchand chercha-t-il à le dissuader?
- Pourquoi ne put-il lui faire entendre raison?
- Comment les soldats trouvèrent-ils l'idée du tambour?
- Que firent-ils?
- Que fit le perruquier du régiment?
- Le tambour parut-il content de sa prise?
- Que fit-il de cette barbe en arrivant?
- Où la plaça-t-il ensuite?
- Parla-t-on longtemps de cette aventure?
- Qu'arriva-t-il à l'armée française après son entrée à Moscou?
- Qu'a-t-elle bientôt obligée de faire?
- Pourquoi l'auteur ne veut-il point faire le tableau de cet horrible désastre?
- Que suffit-il de savoir?
- Où se trouvait le régiment de Bilboquet?
- Que faisaient les Cosaques?
- Qu'avait-on essayé de faire après avoir passé la rivière?
- Pourquoi l'explosion n'avait-elle pas eu beaucoup d'effet?
- Pourquoi la charpente du pont ne tombait-elle pas?
- Qu'est-ce que les ennemis auraient pu faire, s'ils étaient arrivés?

NOTES.

- Faire entendre raison au petit B., induce little B. to listen to reason.
- Il s'engagea une dispute, an altercation commenced.
- From se mettre.
- Remit, delivered.
- Carried it.
- Fit couder, had it sewed.
- Causa, talked, spoke.
- From falloir.
- On se remit en marche, the march was resumed.
- From atteindre.
- Qu'il, let it.
- From suffire.
- S'il restait, if there remained.
- Obéissant, obeying.
- Ils venaient de, they had just.
- Faire sauter, blow up.
- From produire.
- La retenait, supported it.

KEY TO EXERCISES IN LESSONS IN FRENCH.

EXERCISE 89 (Vol. I., page 334).

- Do not your boots fit well?
- They do not fit me well, they pinch me too much.
- Are they too narrow?
- They are too narrow and too short, they hurt me.
- Is the shoemaker gone away?
- He is not yet gone away.
- At what hour did your sister's companions go away?
- They went away about six in the afternoon.
- Is the coat which you hold, yours or your brother's?
- It is neither his nor mine, it is my brother-in-law's.
- Does it fit him well?
- It fits him very well, and becomes him well.
- Where has he had it made?
- He had it made in France or in Germany.
- Whose books are those which your sister reads?
- They are mine.

EXERCISE 90 (Vol. I., page 334).

- Vos amis s'en sont-ils allés?
- Ils ne s'en sont pas encore allés, ils sont encore ici.
- À quelle heure Mme votre mère s'en est-elle allée?
- Elle s'en est allée (est partie) ce matin de bonne heure.
- Votre petite sœur s'en est-elle allée tard?
- Elle s'en est allée trop tôt.
- La robe neuve de Mlle votre sœur lui sied-elle?
- Elle ne lui sied pas.
- Pourquoi ne lui sied-elle pas?
- Les couleurs foncées ne lui siéent jamais.
- Les couleurs claires siéent-elles à l'épouse de M. votre frère?
- Elles lui siéent fort bien.
- Vos bottes neuves sont-elles trop étroites ou trop larges?
- Elles ne sont ni trop étroites ni trop larges, elles vont très bien.
- Le gilet de votre frère lui va-t-il bien?
- Il lui va bien, mais il ne lui sied pas.
- Les couleurs claires ne lui siéent jamais.

EXERCISE 91 (Vol. I., page 342).

- What is it necessary to do to-day?
- To-day it is necessary to work.
- Has it been necessary to work much, to finish the work in time?
- It has been necessary to work the whole day.
- When must we (is it necessary to) write to our friend?
- It is necessary to write to him to-day.
- Must I go to my father?
- You must go to him, he wishes to speak to you.
- Does he need (want) anything?
- He needs books, pens, and ink.
- Does he not need money also?
- He needs much to pay his debts.
- Do you need anything more?
- I need nothing more, I have all that I need.
- Must not your sister have paper?
- She needs no more.
- What must be sent to the surgeon?
- Money must be sent him, he has great need of it.
- Has the milliner all that she needs?
- She has not all that she needs.
- How much must you have? (do you need, require?)
- I must have five francs.
- Do you not need more?
- I need no more.
- What must he have for his trouble?
- He asks for (charges) one franc twenty-five centimes.

EXERCISE 92 (Vol. I., page 342).

- Que nous faut-il faire?
- Il vous faut apporter votre livre, et apprendre votre leçon.
- Faut-il écrire à M. votre frère aujourd'hui?

4. Il ne faut pas lui écrire. 5. A-t-il fallu parler à M. votre père? 6. Il a fallu lui parler. 7. Faut-il aller à D. aujourd'hui? 8. Il faut y aller. 9. Me faut-il aller trouver M^{lle} votre sœur? 10. Il vous faut aller la trouver, elle désire vous parler. 11. Combien d'argent faut-il à votre frère? 12. Il lui faut dix francs cinquante centimes. 13. Combien de livres faut-il à M^{lle} votre sœur? 14. Il lui faut beaucoup de livres, elle lit beaucoup. 15. Que voulez-vous envoyer au chirurgien? 16. Il nous faut lui envoyer notre cheval; le sien est malade. 17. Ne lui faut-il pas du papier? 18. Il lui en faut, il a des lettres à écrire. 19. Lui en faut-il beaucoup? 20. Il lui en faut une main. 21. Vous faut-il encore quelque chose? 22. Il me faut encore quelque chose. 23. Il ne me faut plus rien. 24. Vous faut-il cent francs? 25. Il me faut dix dollars. 26. Que faut-il au chirurgien? 27. Il lui faut de l'argent pour payer ses dettes. 28. Le tailleur a-t-il tout ce qu'il lui faut? 29. Il n'a pas tout ce qu'il lui faut. 30. La modiste a reçu tout ce qu'il lui faut. 31. Que vous faut-il pour votre peine? 32. Combien vous faut-il? 33. Combien nous faut-il? 34. Que me faut-il faire? 35. Il vous faut écrire une lettre. 36. Que lui faut-il écrire? 37. Il lui faut écrire quatre pages. 38. Il lui faut aller à l'église.

EXERCISE 93 (Vol. I., page 356).

1. Does it become you to reproach us with our neglect? 2. It becomes me to reproach you when you deserve it. 3. Does it suit you to go to my brother? 4. It does not suit me to go to him, I have something else to do. 5. How much may that field be worth? 6. It may be worth about twenty thousand francs. 7. Are you better than your brother? 8. My brother is much better than I. 9. Is not that knife worth more than yours? 10. Mine is better, it is worth more. 11. How much is your watch worth? 12. It is not worth much, it does not go well. 13. How much is the merchant worth? 14. I cannot tell you exactly; he is worth about a hundred thousand francs. 15. Is it not better to remain here than to go to market? 16. It is better to go to market. 17. Is your gold chain worth more than mine? 18. It is worth quite as much. 19. It is not worth much, it is broken. 20. Is that worth fifty francs? 21. It is worth at the most two francs. 22. Have you asked the merchant what that is worth? 23. I have not asked him. 24. He assures me that it is worth about one hundred francs.

LESSONS IN ALGEBRA.—III.

ADDITION.

EXAMPLES.—(1.) John has x marbles and gains b marbles more. How many marbles has he in all?

In this example we wish to add x marbles to b marbles. But addition in algebra is denoted by the sign $+$. Hence $x + b$ is the answer, i.e., John has the sum of x marbles added to b marbles.

(2.) What is the sum of $3b$ pounds added to the sum of c pounds and f pounds?

By algebraic notation, $3b + c + f$ pounds is the answer.

44. The learner may be curious to know how many marbles there are in $x + b$ marbles; and how many pounds in $3b + c + f$ pounds. This depends upon the number each letter stands for. But the questions do not decide what this number is. It is not the object, in adding them, to ascertain the specific value of x and b , or $3b$, c , and f ; but we find an algebraic expression, which will represent their sum or amount. This process is called addition. Hence

45. ADDITION in algebra may be defined, the connecting of several quantities with their signs into one expression.

46. Quantities may be added, by writing them one after another, without altering their signs.

N.B.—A quantity to which no sign is prefixed is always to be considered positive, that is, the sign $+$ is understood [Art. 12].

EXAMPLE.—What is the sum of $a + m$, $b - 8$, and $2h - 3m + d$?

47. It is immaterial in what order the terms or letters are arranged. If you add 6 and 3 and 9, the amount is the same, whether you put the 6, the 3, or the 9 first—namely, 18. But it is frequently more convenient, and therefore customary, to arrange the letters in alphabetical order.

48. It often happens that the expression denoting the sum or amount may be simplified by reducing several terms to one. Thus, the expression $2a + 7a + 4a$ may be abridged by uniting the three terms into one. Thus, $2a$ added to $7a$ makes $9a$, and $4a$ added to $9a$ makes $13a$, that is, $2a + 7a + 4a = 13a$.

There are two cases in which reductions can be made.

49. Case 1.—When the quantities are alike, and the signs

alike, as $+4b + 5b$, or $-4y - 3y$, etc. Find the sum of the co-efficients, annex the common letter or letters, and prefix the common sign.

EXAMPLES.—(1.) What is the sum of $3a$, $4a$, and $6a$?

Here, $3a + 4a + 6a = 13a$. Ans.

(2.) $3xy$ (3.) $7b + xy$ (4.) $ry + 3abh$ (5.) $cdxy + 3mg$
 $7xy$ $8b + 3xy$ $3ry + abh$ $2cdxy + mg$
 xy $2b + 2xy$ $6ry + 4abh$ $5cdxy + 7mg$
 $2xy$ $6b + 5xy$ $2ry + abh$ $7cdxy + 8mg$

13xy 23b + 11xy 12ry + 9abh 15cdxy + 19mg

50.—The mode of proceeding is the same when all the signs are —.

EXAMPLES.—(1.) What is the sum of $-3bc$, $-bc$, and $-5bc$?

Here $-3bc - bc - 5bc = -9bc$.

(2.) $-ax$ (3.) $-2ab - my$ (4.) $-3ach - 8bdy$
 $-3ax$ $-ab - 3my$ $-ach - bdy$
 $-2ax$ $-7ab - 8my$ $-5ach - 7bdy$
 $-6ax$ $-10ab - 12my$ $-9ach - 16bdy$

51. Case 2.—When the quantities are alike, but the signs unlike, that is, only one of each, as $+9b$ and $-6b$;

Take the less co-efficient from the greater; to the difference annex the common letter or letters, and prefix the sign of the greater co-efficient.

Suppose a man's loss is £500, and his gain £2,000. The algebraic notation is $-500 + 2,000$, i.e., £500 is to be subtracted from his stock, and £2,000 added to it. But it will be the same in effect, and the expression will be greatly abridged, if we add the difference between £500 and £2,000 viz., £1,500 to his stock.

EXAMPLES.—(1.) What is the sum of $16ab$ and $-7ab$?

Ans. $9ab$.

(2.) $+4b$ (3.) $5bc$ (4.) $2hm$ (5.) $dy + 6m$ (6.) $3h - dx$
 $+6b$ $-7bc$ $-9hm$ $-4dy - m$ $5h + 4dx$
 $-2b$ $-2bc$ $-7hm$ $-3dy + 5m$ $8h + 3dx$

52. If several positive and several negative quantities are to be reduced to one term, first reduce those which are positive, and next those which are negative, to one term, and then proceed as in Art. 51.

EXAMPLES.—(1.) Reduce $13b + 6b + b - 4b - 5b - 7b$, to one term.

Here, $13b + 6b + b = 20b$; and $-4b - 5b - 7b = -16b$;

Whence $20b - 16b = 4b$. Ans.

(2.) Add $3xy - xy + 2xy - 7xy + 4xy - 9xy + 7xy - 6xy$. Here, $3xy + 2xy + 4xy + 7xy = 16xy$.

And, $-xy - 7xy - 9xy - 6xy = -23xy$;

Whence, $16xy - 23xy = -7xy$. Ans.

(3.) Add $3ad - 6ad + ad + 7ad - 2ad + 9ad - 8ad - 4ad$. Here, $3ad + ad + 7ad + 9ad = 20ad$;

And, $-6ad - 2ad - 8ad - 4ad = -20ad$;

Whence $20ad - 20ad = 0$. Ans.

(4.) Add $2abm - abm + 7abm - 3abm + 7abm$. Here, $2abm + 7abm + 7abm = 16abm$;

And, $-abm - 3abm = -4abm$;

Whence, $16abm - 4abm = 12abm$. Ans.

(5.) Add $axy - 7axy + 8axy - axy - 8axy + 9axy$. Here, $axy + 8axy + 9axy = 18axy$;

And, $-7axy - axy - 8axy = -16axy$;

Whence, $18axy - 16axy = 2axy$. Ans.

53. If two equal quantities have contrary signs, they destroy each other, that is, the results of their addition is 0, and they may be cancelled. Thus $+6b - 6b = 0$. And $(3 \times 6) - 18 = 0$, so $7bc - 7bc = 0$.

54. If the letters, or quantities in the several terms to be added, are UNLIKE, they can only be placed after each other, with their proper signs (Art. 46).

EXAMPLES.—(1.) If $4b$, $-6y$, $3x$, $17h$, $-5d$, and 6 , be added, their sum will be $4b - 6y + 3x + 17h - 5d + 6$.

(2.) Add aa , aaa , to xx , xxx , and $xxxx$.

Different letters, and different powers of the same letter, can no more be united in the same term, than pounds and guineas can be added, so as to make a single sum. Six guineas and four pounds are neither ten guineas nor ten pounds; therefore the sum of the above $= aa + aaa + xx + xxx + xxxx$.

55. From the foregoing principles we derive the following

GENERAL RULE FOR ADDITION.

Write down the quantities to be added without altering their signs, placing those that are alike under each other; and unite such terms as are similar.

Otherwise.—Write the quantities to be added one after another, putting the sign $+$ between them, and then simplify the expression by incorporating like quantities.

Note 1.—If any of the quantities be in brackets and the sign $+$ before the brackets, the brackets may be removed without altering the result.

By brackets is meant the vinculum or parenthesis, already explained [Art. 21]. This is one of the most important things in the study of Algebra; its use is unlimited. If quantities be included in any manner between brackets or parentheses, they must be treated as a single quantity, that is, the result of the operation of the signs within the brackets is to be used instead of the quantities themselves, as a general rule. If the signs of the quantities within the brackets be either plus or minus, or a combination of both, and if a factor be outside the bracket, each of the quantities within may be multiplied by that factor, preserving their signs, and the product will be the same as if the result were multiplied by that factor. Thus, $x(a + b - c) = ax + bx - cx$; or, if $a + b - c = e$; then $x(a + b - c) = ex$. Conversely, if the result of the quantities within the brackets be multiplied by any factor, the result will be the same as if each of the quantities were multiplied by that factor. Thus, if $a + b - c = e$; then, $ex = (a + b - c)x = ax + bx - cx$. If several factors be employed, the same results will take place. Thus, $axy + bxy - cxy = xy(a + b - c) = (a + b - c)xy$; and $mcd + ncd + pcd = cd(m + n + p) = (m + n + p)cd$; and $pxyz + qxyz - rxyz = xyz(p + q - r) = (p + q - r)xyz$. Expressions of this kind may be varied indefinitely.

Note 2.—If the sign $-$ be before the brackets, they cannot be removed without vitiating the result, until the signs of all the terms within the brackets be changed, viz., $+$ into $-$, and conversely.

EXAMPLE.—To $3bc - 6d + 2b - 3y$, add $-3bc + x - 3d + 6g$, and $2d + y + 3x + b$.

These may be arranged thus: $3bc - 6d + 2b - 3y$
 $-3bc - 3d + x + by$
 $2d + b + y + 3x$
 And the sum will be $-7d - 3b - 2y + 4x + by$

EXERCISE 4.

Add together the following quantities—

- $ab + 8$, to $cd - 3$, and $5ab - 4m + 2$.
- $x + 3y - dx$, to $7 - x - 8 + hm$.
- $abm - 3x + bm$, to $y - x + 7$, and $5x - 6y + 9$.
- $3am + 6 - 7xy - 8$, to $10xy - 9 + 5am$.
- $6ahy + 7d - 1 + mxy$, to $3ahy - 7d + 17 - mxy$.
- $7ad - h + 8xy - ad$, to $5ad + h - 7xy$.
- $2by - 3ax + 2a$, to $3bx - by + a$.
- $ax + by - xy$, to $-by + 2xy + 5ac$.
- $4icdf - 10xy - 18b$, to $7xy + 21b + 3cdf$.
- $8bc - 17xy + 18a$, to $4ax - 5bx + 63cx$.
- $3ab - 6bc + 4cd - 7xy$, to $17mn + 18fg - 2ax$.
- $-2abc + 10abd$, to $50abc + 15abd + 5xyz$.
- $ay - y + 6 - df + 4a$, to $4df - 20 + 3ax + 75y$.
- $4ba - 10b + 4cdf$, to $82b - 4cdf + 10a - 4b$.
- $12(a + b) + 3(a + b)$, to $2(a + b) - 10(a + b)$.
- $xy(a + b) + 3xy(a + b)$, to $2xy(a + b) - 4xy(a + b)$.
- $ax + aa, x + xxx, 4aa + 2x + ax$, and $2xxx$.
- $xy + xy + xy, 2xx + 10yy$, to $4xy + 6y - 8xx$.
- $aaa + 4aaa$, to $10aa - 14aaa + 8aaa$.
- $12yyyy - 10xx$, to $20xx - 8yyyy + 2xx + 3yyyy$.
- $4(x - y) - 13$, to $(a + b) - 16(x - y) - 7(a + b)$.
- $a(x + y) - 6y$, to $40(a - b) + 8a(x + y) - 36(a - b)$.
- $10axy + 17bcd - axy$, to $6axy - 14bcd$.
- $-x + y + 6x(a - b) - 7x$, to $16y - 15x(a - b) + 25x$.
- $-4(x + y) + 16(x + y)$, to $15abc - 10(x + y)$.
- $abc - 6xy + mn$, to $6abc + 14xy - 11a + 6mn$, to $15xy - 17abc$.
- $-abc + xy - 3mn + abc$.
- $a(x + y) - 2b(x + y) - 4a(x + y) - \frac{1}{2}(x + y) - (x + y)$, to $4b(x + y) + 7a(x + y) + 5(x + y) + 6b(x + y)$.

Note.—As the expressions x^2 (square x), y^3 (cube y), etc., are used for the first time in the following exercises, the learner is referred to Art. 28:—

- ax^2, ax, y^3, xy^2 , and $3by^2$.
- $a^3 - 2ab - 8ab^2 + 2b^3, 3a^2 - ab - 4ab^2 + 10b^3, 2a^2 - 3ab - 6ab^2 - b^3$, and $5a^3 - 4ab^2 - ab^2 + 3b^3$.
- $x^3 - 5x^2 - 3x + 1, 2x^3 + 6x^2 + 5x + 3, 3x^3 - 2x^2 - x - 1$, and $4x^3 - x^2 + 2x - 5$.
- $x^2 + a + b + c + d, a - b + c + d, a + b - c + d$, and $a + b + c - d$.
- $a - 2b, 2b - 3c, 3c - 4d, 4d - 5e$, and $5e - 6f$.
- $y^3 + 2y^2 - 3y^2, 2y^3 + 2y^2 + 5y^2$, and $3y^3 - 4y^2 - 2y^2$.
- $ax^3 + bx^3, bx^3 - cx^3$, and $cx^3 + dx^3$.
- $m^2 - nx, nx^2 - px$, and $2x^2 - z$.

KEY TO EXERCISES IN LESSONS IN ALGEBRA.

EXERCISE 1.

- $(a - b) \times (b + c + d) = 37m + \frac{b}{h + b}$.
- $a + b : \frac{b}{c} :: ac : 12h$.
- $\frac{a + b + c}{6abc} = \frac{1}{4}(a + b + c) - d$.
- $\frac{6}{a + b} = 7d - \frac{b}{36}$.

EXERCISE 2.

- The product of a and b increased by the quotient of 3 times h minus c , divided by the sum of x and y , is equal to the product of d by a increased by the sum of b and c , and diminished by the quotient of h divided by the sum of 6 and b .
- If a be added to 7 times the sum of h and x , and from this sum, the quotient of c less 6 times d , divided by the sum of twice a and 4, be subtracted, the remainder will be equal to the sum of a and h , multiplied by the difference of b and c .
- The difference of a and b , is to the product of a and c , as the difference of d and 4, divided by m , is to 3 multiplied by the sum of h , d , and y .
- If the quotient of the difference between a and h , divided by the sum of 3, and b less c , be added to the quotient of the sum of d and the product of a and b , divided by twice m , the whole will be equal to the quotient of b times a multiplied by the sum of d and h , divided by a times m , lessened by the quotient of c times d divided by h increased by d times m .

EXERCISE 3.

- $\frac{3 \times 6}{2} + 3 + 8 \times 10 = 9 + 3 + 80 = 92$.
- $\frac{4 + 80}{2 \times 6} + \frac{(4 \times 2) + 10}{3 \times 6} = \frac{84}{12} + \frac{18}{18} = 7 + 1 = 8$.
- $\frac{4 + (3 \times 6)}{2} + (4 \times 2 \times 8) = \frac{4 + (4 \times 2 \times 10)}{2} = \frac{4 + 18}{2} + 64 = \frac{84}{2} = 42 + 64 = 106$.
- $4 \times 8 + \frac{(3 \times 4) + (3 \times 6)}{6} - \frac{(3 \times 4 \times 10) - (6 \times 2)}{3 \times 2 \times 6} = 32 + \frac{12 + 18}{6} - \frac{120 - 12}{36} = 32 + \frac{30}{6} - \frac{108}{36} = 32 + 5 - 3 = 34$.
- $(3 \times 4 \times 8) + \frac{2 \times 4}{8 - 4} + (2 \times 10) = 96 + \frac{8}{4} + 20 = 118$.
- $(3 + 2) \times (10 - 8) + \frac{9 - 4}{8 - 6} - 3 = 5 \times 2 + \frac{5}{2} - 3 = 10 + 2.5 - 3 = 9.5$.
- $\frac{3 \times (6 + 2)}{10 - 6} + (3 \times 4 \times 2) - \frac{(2 + 4) \times (8 - 6)}{10 - (4 \times 2)} = \frac{24}{4} + 24 - \frac{24}{10} = 6 + 24 - 2.4 = 27.6$.
- $\frac{(3 \times 2) + (5 \times 8)}{(2 \times 10) + 3} + 8 - (2 \times 4) + \frac{(4 \times 6 - 4) \times (3 - 2)}{10} = \frac{6 + 40}{23} + 8 - 8 + \frac{20}{10} = \frac{46}{23} + 0 + 2 = 2 + 2 = 4$.

LESSONS IN ENGLISH.—XXVIII.

LATIN STEMS.

We are about to lay before the student a large portion of the roots of the Latin language. In the study of them, he may become acquainted with the treasures of the Roman literature, and the tone and strength of the Roman mind. These lessons do not indeed, lie on the surface. Nevertheless, they are to be learnt by care and diligence. For this purpose, the learner should impress on his mind the preceding remarks, and remembering that a language is the mirror of a nation's mind, accustom himself to see and contemplate the Romans in their words—those unerring tokens of thought, those mental miniatures.

Of course it is only so much of the Latin vocabulary as exists in English that I shall set forth in these pages. The Latin

words found in English exist almost exclusively in combination. The combinations in which they appear vary in kind. The combination may consist of one word and a suffix, or one word and a prefix; or, again, of two words with or without terminating forms. The combinations require certain changes. The changes are effected by dropping or altering the Latin termination, or by the substitution of one vowel for another, as *i* for *a*, *e* for *a*, etc.

Latin Words.	Meanings.	Stems.	English Words.
Acer (acris) sharp		acri	acrimony.
Ædes a house		edi	edifice.
Facio I make		fi, fy	ratification, edify.
Æquus equal		equa, equi	equanimity, equilibrium.
Animus mind		anim	animosity.
Libra a pound or balance		libr	libration, equilibrium.
Aer air		aeri	aerial, aeriform.
Ævum an age		ev	coeval.
Ager (agri) a field		agri	agriculture.
Cultura cultivation		cultur	culture.
Agger a heap		agger	exaggerate.
Ago I do, act		ag	agent, agency.
Ala a wing		act	actor, active.
Pes (pedis) a foot		all	aliped.
Altus high		ped	pedestrian.
Amicus a friend		alt	altitude, exalt.
Amo I love		amic, imic	amicable, inimical.
Anima life, the soul		ami, amor, amat	amiable, amorous, amatory.
Verto I turn		anim	animate.
Ad to		animadvert	animadvert.
Annus a year		ad	adequate.
Bis twice		ann, annu, enni	annual, biennial.
Aqua water		bi	biped.
Ductus a leading		aqua, aque	aquatic, aqueduct.
Arceo I keep off		duct	conduct.
Aro I plough		erce	coerce.
Ars (artis) art		ar	arable.
Artis a joint		art, ert	artifice, artist, inert.
Asper rough		arti	articulation.
Audio I hear		asper	asperity, exasperate.
Augeo I increase		audi, audit	audience, auditor.
Auctio an increasing		aug	augment.
Auctor an originator		auct	auction.
Avis a bird		auth	author.
Beatus blessed		avi	aviary.
Bellum war		beati	beatitude.
Gero I carry on		belli, bel	belligerent, rebel.
Re back, in opposition		ger, gest	belligerent, gesture.
Bellus beautiful		re	repel, repulse.
Bene well		bell	embellish, belle.
Dictio a saying		bene	benediction.
Bibo I drink		dictio	malediction.
Bini two, each		bib	wine-bibber, imbibe.
Brevis short		bina	combination, binary.
Cado I fall		brev	brevity, abbreviate.
Casus a fall		cad, cid	cadaverous, accident.
Cædo I cut		cas	casual.
Cæsus cut		cid	homicide.
Calor heat		cis	incision, precision.
Candeo I burn		calor	caloric.
Candesco I begin to burn		cens, cend	incense, incendiary.
Canis a dog		candesc	incandescence.
Cano, canto I sing		can	canine.
Capillus hair		cant, cent	canticles, precentor.
Caput (capitis) the head		capill	capillary.
Capio I take		capit	capitular.
Carcer a prison		capit	precipitate.
Caro (carnis) flesh		cap, capt, cip	capable, capture, anticipate.
Voro I devour		cipi, cept	recipient, receptive.
Carus dear		carcer	incarcerate.
Cedo I give place to		carni, carn	carnivorous, incarnate.
Celer swift		cor	voracious.
Centum a hundred		car	carress.
Cerno I separate, see		ced	recede.
Cretus separated		cens	concession, access, success.
Ceto a whale		celer	celerity, accelerate.
Cinctus girded		cent	century, centennial.
Citus quickly moved		corn	discern.
Clamo I call out		cret	secretion, discre(e)t.
Clarus clear		cet	cetaceous.
Claudo I shut		cinct	succinct, precincts.
Clausus shut		cit	cite, excitement.
		clam, claim	exclamation, proclaim.
		clar	clarify, declare.
		clud	include, exclude.
		claus, clus	clause, seclusion.

Latin Words.	Meanings.	Stems.	English Words.
Clinio I bend, lie		clin	clinical, recline.
Clivus a slope		cliv	declivity, declivity.
Colum heaven		col	celestial.
Colo I cultivate, inhabit		col	colony.
Comes (comitis) a companion		comit	concomitant.
Copia plenty		copi	copious.
Coquo I cook		coo	co(o)k, to cocker.
Cocus cooked		coc	decoction.
Cor (cordis) the heart		cord	cordial, concord.
Cornu a horn		corn	unicorn, cornet.
Corpus the body		corpu, corpuscle, corpulent.	incorporate.
Corporis (corp) the body		corpu	procrastinate.
Cras to-morrow		cras	cre(c)d, credulous, cred-ible, credit.
Credo I believe, trust		ored	cremation.
Crema I burn		crem	cremation.
Crux (crucis) a cross		cruc	crucifix.
Cubo I lie		cub	incubation.
(cumbo) I lie		cumb	incumbent.
Culpa a fault		culp	culpable, culprit.
Cura care, cure		cura, cur	curator, sinecure.

The meaning of many of the words given as examples the student will either know already or may deduce from the etymology. In other cases some additional aid may be required. That aid I shall supply in quotations and in such remarks as the several topics may seem to require.

"Those milks (in certain plants) have all an acrimony, though one would think they should be lenitive."—Bacon, "Natural History."

"Most satirists are indeed a public scourge, Their mildest physic is a farrier's purge, Their acrid temper turns, as soon as stirred, The milk of their good purpose all to curd."—Corper.

Acer is properly that which is sharp, as the point of a spear, or the edge of a sword, that which pricks or cuts; whereas acerbus (acerbity) denotes that which is bitter to the taste. According to its derivation, edification is house-building. The spiritual house is intended, the metaphor being borrowed from the diction of the New Testament. Consult 1 Cor. iii. 9; xiv. 3; Ephes. ii. 21; iv. 12, 16.

"So that it is by the equilibrium of the muscles, by the aid of a considerable and equipollent (equally powerful) muscular force in constant exertion, that the head maintains its erect posture."—Paley, "Natural History."

"Government has coercion (restraint) and animadversion upon such as neglect their duty."—South.

Articulation is properly the making of articles, that is, small limbs or joints; hence dividing a flow of sound so as to produce separate and distinct sounds, that is, letters and syllables. This power belongs only to man. Accordingly, Milton, that great master of distinctive and descriptive epithets, gives as the characteristics of the human race that they articulate.

"The first of these, at least, I thought denied To beast, whom God on their creation-day Created mute to all articulate sound."

"The former (fore) legs of this animal (the elephant) appear, when he standeth, like pillars of flesh without any evidence of articulation."—Brown, "Vulgar Errors."

"Pere Bougeant's third volume will give you the best idea of the Treaty of Munster, and open to you several views of the belligerent and contracting parties."—Chesterfield.

Derivatively considered, to combine is to put things together in pairs, but it is employed without this restriction to signify to put together generally.

"The impediments were—first, the negligence of the pastors; secondly, combinations, that is double benefices, when men having two cures could not sufficiently attend both."—Hales.

"Few painters have obliged us with finer scenes, or have possessed the art of combining woods, lakes, and rocks into more agreeable pictures than G. Poussin."—Hurd.

It is curious to see in incubation, the act of the hen in setting on her eggs, and incubency, the condition of a clergyman as occupant of a living, how the same stem, and very nearly the same letters, may come to signify things so very unlike.

Cadaverous comes immediately from cadaver, a corpse, and denotes the colour or complexion of a corpse. Cadaver, a corpse, by its etymology points out the fact which denotes death, namely, falling, from cado, I fall. A dead body cannot stand.

"The subject of the present chapter will be the offence of homicide, or destroying the life of man, in its several stages of guilt, arising from the particular circumstances of mitigation or aggravation which attend it."—Blackstone, "Commentaries."

Homicide, that is, in its corresponding Saxon term, manslaughter, denotes the general act of man-killing, leaving it to be decided whether the killing was or was not murder, that is, premeditated killing. Unpremeditated man-killing is generally termed manslaughter, as contradistinguished from murder. It deserves attention, that not one of these words, homicide, manslaughter, man-killing, murder (Ger. mord, murder; Fr. mort, death; and Lat. mort, death), conveys in itself the idea of "malice aforethought."

Clinical is a scientific word, and, like most of our scientific words, may have come to us from the Greek; for the Greek *klino* is the root of the Latin *clino*, and is similar to it in import. A clinical lecture is a discourse on a disease, delivered by the bedside of the patient. A clinical convert is one that is converted on his death-bed. In the early history of the churches, those were called *clini* or *clinical*, who, wishing to have all their sins washed away at once, postponed baptism till their dying hour. See Gibson's remarks on the delay of baptism by Constantine, misnamed the Great.

"Horror stalks around Wild staring, and his sad concomitant Despair, of abject look."—Philips.

"I persuaded her to take, as hot as she could well drink it, every morning, a full draught of the decoction of centaury boiled in beer or ale."—Bayle.

Cordial, of Latin origin, has a corresponding word from the Saxon, that is, hearty. This is by no means a solitary case, as will appear from the ensuing list:—

Latin.	Saxon.	Latin.	Saxon.
Timid	fearful.	Altitude	height.
Velocity	swiftness.	Annual	yearly.
Effeminate	womanish.	Aqueous	watery.
Edifice	building.	Auditor	hearer.
Paucity	fewness.		

In incorporate, animadvert, and other words, the student is expected to make use of the information which he has already had supplied to him regarding prepositions in combination, as well as regarding prefixes and suffixes.

Cremation, burning, is applied particularly to the ancient custom of destroying corpses by fire. The Chinese, without cremation or urnal interment of their bodies, make use of trees and much burning, while they plant a pine-tree by their grave."—Brown, "Urn Burial."

Capillary signifies that which is like hair; hence it is applied to the small vessels of the body, as the ramifications (branches) of the arteries, "the capillaries;" also to tubes; and attraction in tubes as fine as hair, is called "capillary attraction."

"A strict and succinct style is that where you can take away nothing without loss, and that loss to be manifest."—Ben Jonson.

"To translate him line for line is impossible, because the Latin is naturally a more succinct language than either the Italian, Spanish, French, or even the English; which by reason of its monosyllables, is far the most compendious of them."—Dryden.

The idea in succinct, girded, is taken from the custom prevalent among the ancient Greeks and Romans of gathering up and binding around the waist their long flowing robes, when they were about to apply to any manual occupation. Compare Isa. viii. 9; John xiii. 4, 5.

EXERCISES IN COMPOSITION.

Words with their proper Prepositions to be formed into sentences.

WORDS.	FOREIGN REPRESENTATIVES.
Clear of,	clarus, bright, distinct.
Coalesce with,	coalesco, I grow together.
Coincide with,	cum, in, cado, I fall in with.
Commune with,	communis, common.
Commit to,	cum, mitto, I send with.
Communicate to,	communico, I communicate.
Compare to (in respect to quality),	comparo, I compare, match.
Compare with (by way of illustration),	

EXERCISE IN PARSING.

Some have termed the "Song of Solomon, or the Canticles," a Hebrew Epithalamium. The rage for autographs seems to have in a

measure subsided. The autographs of the writers of the New Testament are not known to exist. The word *apology* sometimes signifies defence rather than excuse. The former is the older meaning of the term. The monuments of Egypt are covered with hieroglyphics. The hieroglyphics of Egypt have for the most part been at length deciphered. Exodus is the name borne by the second book in the Bible. This name was given to the book because it recounts the departure of the children of Israel out of the land of Egypt.

To endeavour to improve yourself in composition, report the following anecdote, as before, to a child or to a class of children:—

ESCAPE OF THE DUKE OF ALBANY.

King James III. of Scotland, after his marriage with Margaret, Princess of Denmark, having disgusted his proud nobility by patronising and receiving into favour many persons of inferior rank, deep and dangerous intrigues were formed against him. By these minions and upstart counsellors he was speedily made aware that his brothers—Alexander, Duke of Albany, and John, Earl of Mar—were forming conspiracies against him, and that the former aimed at nothing less than wresting the sceptre from his hand—a fact which has since been proved by authentic documents. In 1482, Albany was committed to the Castle of Edinburgh, where he was kept a close prisoner by those who knew that his accession to power would assuredly be their destruction. He had not been long in durance until he formed and matured a plan of escape, which, with desperate courage, he executed in the following manner. Terrified by the mysterious fate of Mar, and aware that his day of trial was approaching, some of Albany's numerous friends in France or Scotland contrived means to acquaint him that a small vessel, laden with Gascon wine, lay in the roadstead of Leith, by which he might escape if he made an effort. The tower in which he was confined was probably David's, for we are informed that it "arose from the northern verge of the rock on which the castle is founded, where the height of the precipice seemed to bar all possibility of escape." He had but one attendant (styled his chamber-chield) left to wait upon him, and to this trusty follower alone he revealed his intention. From the French vessel he received two small runlets or barrels of wine, which luckily the castle-guard permitted to be carried into his apartment untasted and unexamined. On opening them in private the duke found that they contained Malvoisie, and, what was of more importance, a strong rope and a waxen roll inclosing an anonymous letter, urging him to lose no time in attempting to escape, as the king's minions had determined he should die ere the morrow's sunset; and the billet ended by an assurance that the boats of the French vessel should await him at the shore of Leith. The first point to be gained was to lull the suspicions of the captain of the guard, for which purpose the duke invited him to supper, and by pressing him and three of his soldiers to drink freely of the Malvoisie, succeeded in partially intoxicating them. After gaming and drinking until the hour grew late, Albany found the moment for action had come. Rushing upon the captain he snatched a long dagger from his baldric, and buried it repeatedly in his breast; then, quick as thought, he dispatched the intoxicated soldiers in the same manner, and, in token of his hostility and contempt (with the assistance of his chamber-chield), he savagely threw the bodies on the great fire that blazed in the stone fire-place of the tower; and there in their armour they broiled and sweltered like tortoises in iron shells. Having secured the keys of the doors, they locked them as they retired, and stealthily hurried to the wall, which they prepared to descend at the most retired part. The chamber-chield lowered himself first over the beetling crag, which is two hundred feet in height, but the cord proving too short, it slipped suddenly through his hands, he fell to the bottom, and there lay senseless. We may imagine how the heart of the blood-stained Albany must have beat at this terrible crisis! Every moment was fraught with danger, and his death or life were hanging by a hair. Rushing back to his apartment in the tower, he tore the sheets from his bed, twisted them into a rope, lengthened the cord, looped it around an embrasure, and, lowering himself over the rampart, and the rugged rocks it overlooked, reached the bottom in safety. There he found his attendant stretched on the ground, with his thigh-bone broken. Unwilling to leave behind him, to the mercy of his enemies, one who had been so faithful, Albany, with a sentiment of gratitude which seems almost incompatible with his previous ferocity, lifted him on his shoulders, and, being a man of gigantic stature and uncommon strength, carried him thus with ease to Leith, where they embarked without delay; and setting sail before the rising sun brightened the German sea, cast anchor under the towers of Dunbar, the patrimonial castle of Albany. During the whole night nothing was known of his escape; but daylight revealed the rope and twisted sheets hanging over the northern ramparts; there was immediately given an alarm, which the dreadful stench in David's tower must have increased. His flight was discovered, and the half-consumed corpses were found in the fire-place of his chamber. Enraged and confounded, James III. refused to credit the intelligence until he had examined the place in person.—*Memorials of the Castle of Edinburgh*, pp. 52-55.

LESSONS IN BOTANY.—XXVIII.

SECTION LXIII.—AMPELIDÆ, OR VITACEÆ, THE VINE FAMILY.

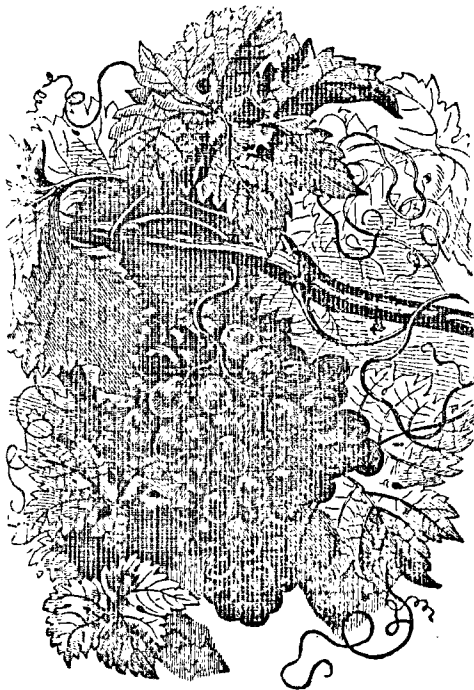
Characteristics: Calyx free; petals four to five inserted upon the border of a hypogynous, or sub-perigynous disc; aestivation valvate; stamens five, opposite to the petals; ovary two, three, or six celled; ovules ascendant, erect, or reflexed; berry two to six celled; ovule dicotyledonous, straight, very minute, lying at the base of a hard albumen; stem ligneous; leaves palmilobed, digitate, or pinnate.

The *Ampelidæ* or *Vitaceæ* are generally trees or shrubs supplied for the most part with tendrils, containing an abundance of aqueous juice, and having contorted knotty branches. The lower leaves are opposite, the upper ones alternate; stipules very small, sometimes absent. The flowers are minute, greenish in colour, arranged in a multifloral panicle or a corymbiform cyme. Calyx very small, obscurely dentated, and nearly entire, surrounded by a disc, on which the petals and stamens are borne. The corolla is polypetalous, or almost polypetalous; style very short, stigma terminating in a flattened head. Seeds contained in a horny shell; radicle inferior.

The *Vitaceæ* inhabit all the inter-tropical region, and especially that of Asia. Beyond the tropics they are rare, more especially the Tropic of Capricorn. None are found indigenous to Europe; and if wild vines are found in the forests of this continent, the plant is to be regarded as having escaped from domesticity.

The true country of the vine seems to be Mingrelia and Georgia, between the mountains of the Caucasus, Ararat, and Taurus. The most ancient traditions mention the vine as having been made use of by man, the culture of which may be said to be coeval with the advent of man upon the globe.

If we examine geographically the culture of the vine as at present circumscribed, we shall find the northern limit of the region to be bounded on the western coast of Europe by the embouchure of the Loire. This limit, stretching away to the east, approaches still further towards the north until it attains the fifty-first parallel of latitude at the confluence of the Rhine and Moselle. Vines which grow to the north of this limit no longer furnish wine, and scarcely yield decent vinegar. The culture of the vine succeeds in the valleys of the Rhine and Danube. In Hungary it does not prosper north of the forty-ninth degree of north latitude; and in Central Russia it stretches along the northern coast of the Caspian under the forty-eighth parallel. This limit, if viewed in its ensemble, corresponds with an arc, the extremities of which rest westward on the forty-seventh, eastward on the forty-eighth parallel, and the curve of which rises as high as the fifty-first degree of north latitude. This curvature is explained by the fact that more heat in given time is furnished to plants growing inland than to those which grow near the sea-coast. Passing on from the Caspian Sea towards the East, we see that the vine is not unknown in Bokhara and Northern Persia; but on the southern declivity of the Himalaya Range it becomes rare, and altogether disappears in the valley of the Indus and the maritime region of Persia. South of the twenty-ninth degree of north latitude it requires to be protected against the ardour of the sun. Under the tropics the vine is sometimes planted in gardens. It grows rapidly, but the fruits always wither before arriving at perfection. In North America the vine is not cultivated beyond the thirty-eighth degree, but many delicious kinds of wine are made in the United States. In the southern hemi-



213. THE CORINTH GRAPE.

sphere vines are planted, and arrive at perfection at the Cape of Good Hope, on the coasts of Chili, at the embouchure of the Rio de la Plata, and in Australia. It is, however, the south of France which must be regarded as the especial land of the vine.

The greater number of the *Vitaceæ* contain acids of various kinds distributed throughout all parts of the plant, and in various proportions; sometimes in the pure condition, sometimes mixed with other principles. In the berry of certain species is found a kind of sugar named by chemists *glucose*, otherwise known as grape sugar. It is in consequence of the presence of this sugar that the juice of the berries when expressed ferment and give rise to wine, a drink which we have scriptural authority for saying "rejoices the heart of man." The general theory of wine-making is as follows:—The ripe berries contain glucose, much water, a fermentive principle, mucus, tannic, malic, and nitric acids, and bitartrate of potash (cream of tartar), in addition to many other salts and colouring matters. The grapes are crushed by the naked feet of workmen in large cisterns of wood or stone. On the expiration of a certain time, fermentation commences amongst the various principles of the grape; the mass becomes hot, owing to certain chemical compositions and decompositions which are taking place; sugar becomes changed into alcohol and carbonic acid, and the liquor becomes inebriating. A scum now rises, which is nothing more than the partially decomposed ferment, and collects in a thick crust. After the lapse of a few more days fermentation ceases. The wine is now formed, and only requires to be cleared. Red wine owes its colour to the presence of a blue resinoid principle resident in the pellicle of the fruit. The free acids contained in wine cause this blue colour to change to red. This principle, insoluble in water, is soluble in alcohol, and therefore colours the wine in proportion as the alcoholic fermentation has become developed. Taking advantage of these principles, nothing is more common than the preparation of white wine from dark grapes; all that is necessary to effect the result being the removal of the expressed juice from the grape husks before alcoholic fermentation has set in.

The preparation of sparkling wines is effected by bottling the juice before fermentation has quite ceased. In this way a portion of carbonic acid, which would have escaped under other circumstances, is forcibly retained and dissolved in the wine.

When grapes are dried they constitute raisins. The drying process is either conducted in the sun or artificially. Raisins of Malaga, of Damascus, and of Corinth (currants), are all sun-dried. Valencia and all other raisins are dried by artificial means. The native American representatives of the vine, *Vitis vulpina* and *Vitis labrusca*, are but poor substitutes for the species of the Old World, the berries being harsh tasted and sharp in flavour; nevertheless, the American native grape is not altogether despicable, although it has gained the name of "fox-grape," from its sourness.

The varieties of the common vine now known are far too numerous for enumeration. Perhaps of all these varieties the one possessing most interest is the little Zante or Corinth grape, which yields our so-called currants—a corruption, by the way, of *Corinths*. Strange to say, this grape, if planted very far away from the Grecian Archipelago, ceases to yield the peculiar grape, but degenerates, and furnishes grapes of ordinary size and character. A representation of the Corinth grape is subjoined (Fig. 213). These grapes are extensively cultivated in Zante and others of the Ionian Islands for exportation.

SECTION LXIV.—ARALIACEÆ, OR IVY WORTS.

Characteristics: Calyx adherent to the ovary; petals five or ten inserted upon an epigynous disc, sessile; valvular in aestivation; stamens inserted with the petals, in number equal to the latter, and alternate with them, or double their number; ovary inferior, three or more celled, cells uniovulate; ovules pendent, reflexed; styles equal in number to the cells, distinct or coherent; fruit bacciform, dry, or fleshy; seed inverse, dicotyledonous; embryo very small at the base of a fleshy albumen; radicle superior.

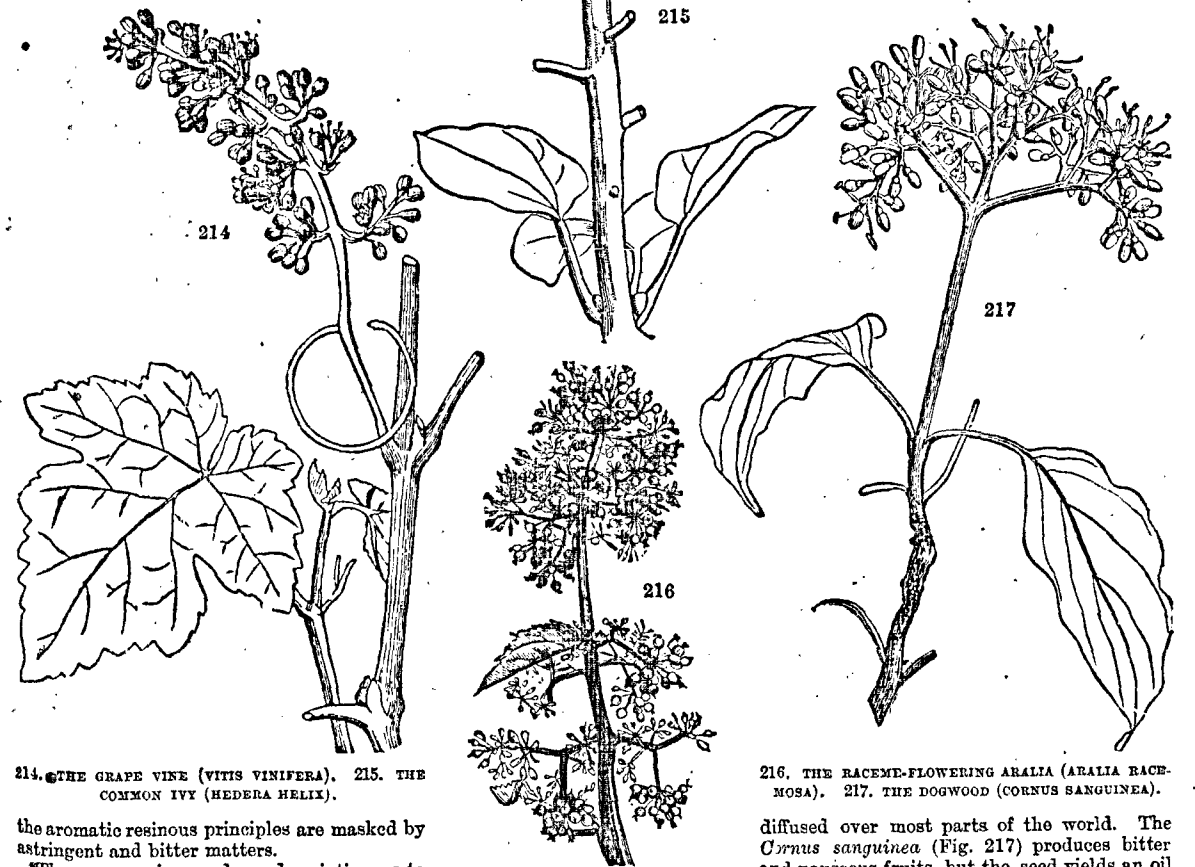
The *Araliaceæ* generally possess a woody stem, and have for the most part alternate and stipulate leaves. Flowers regular, capitular, umbelliferous, or in racemes.

The *Araliaceæ* are inhabitants of tropical and temperate regions of both hemispheres. This natural order has a certain resemblance to the *Umbelliferae*, both in general aspect and chemical qualities. In *Araliaceæ*, however,

four, alternate with the petals; ovary inferior, two-celled, cells uniovular; ovules pendent, reflexed; style simple; fruit baccate, two or three celled; seeds inverted; embryo dicotyledonous, straight in the axis of a fleshy albumen; radicle superior.

The *Cornaceæ* are generally trees or shrubs with opposite, simple, ex-stipulate leaves; flowers disposed in a capitulum, umbel, or corymb. The *Cornaceæ* are allied with the *Caprifoliaceæ*, from which, however, they may be distinguished by their free petals. They are also allied with *Araliaceæ*, but differ in their two-celled ovary and opposite leaves.

The *Cornaceæ* inhabit the temperate and cool regions of the northern hemisphere. Certain members of the order possess in their bark a peculiar bitter principle termed *cornine*, also an astringent matter. Some produce edible fruits and oily seeds. The greater number possess a wood of great hardness. The cornel-tree (*Cornus mascula*) is generally

214. THE GRAPE VINE (*VITIS VINIFERA*). 215. THE COMMON IVY (*HEDERA HELIX*).216. THE RACEME-FLOWERING ARALIA (*ARALIA RACEMOSA*). 217. THE DOGWOOD (*CORNUS SANGUINEA*).

the aromatic resinous principles are masked by astringent and bitter matters.

The common ivy needs no description as to general appearance. Its leaves, when bruised, are aromatic, and their juice, incorporated with fatty matter, constitutes a good application to burns. The ginseng (*Panax Schinseng*) grows in Tartary, China, and Nepal. Its root contains a bitter, an acid, and a saccharine matter. The plant enjoys in Asia an immense reputation as a tonic, and sells for three times its weight in silver. *Panax quinquefolium* grows in North America; its root is collected and sold to the Chinese as a substitute for the real ginseng. The *Aralia nudicaulis*, a North American plant, is celebrated as a sudorific, and its roots are used for the purpose of adulterating sarsaparilla.

SECTION LXV.—CORNACEÆ, OR CORNELS.

Characteristics: Calyx adherent to the ovary; petals four, inserted upon an epigynous disc, valvate in aestivation; stamens

diffused over most parts of the world. The *Cornus sanguinea* (Fig. 217) produces bitter and nauseous fruits, but the seed yields an oil useful for illumination and the fabrication of soap. The *Benthamia fragifera*, or strawberry-fruited Benthamia, is a shrub of Nepal and Japan, now generally cultivated in European gardens. The name *fragifera* is given to this plant on account of its bearing a fruit similar in general appearance to a strawberry. The *Cornus florida* is a North American shrub. It possesses an astringent bark, and is employed as a substitute for quinine by American medical practitioners. The *Aucuba Japonica*, or variegated laurel, is a Japanese evergreen, with shining, opposite, coriaceous leaves, and diceous, small axillary flowers, disposed in panicles. Ovary adherent, unilocular, uniovulate; ovule pendent, reflexed. Fruit, a scarlet berry. This shrub, which is full of ramifications and very elegant, is a well-known garden ornament.

LESSONS IN GERMAN.—XXXVIII.

SECTION LXXIV.—IDIOMATIC PHRASES (continued).

Nicht wahr? is it not true (literally, not true?), answers to our phrases, "isn't it?" "wasn't it?" "don't they?" etc., after an assertion; as:—Es ist kaltes Wetter, nicht wahr? it is cold weather, is it not? Sie kennen ihn, nicht wahr? you know him, do you not? Sometimes nicht wahr precedes the assertion, as:—Nicht wahr, Sie sind müde, are you tired, are you not?

1. Aufwarten (compounded of the *particle* auf and *warten* (§ 90) signifies to wait upon, to serve, and governs the dative. Ich warte Ihnen auf, I wait upon you. Darf ich Ihnen mit einer Tasse Thee aufwarten? may I serve you with a cup of tea? Ich danke Ihnen, sometimes abbreviated to Ich danke, means in addition to our "I thank you," also, "No, I thank you," according to the signification intended to be given. Ich bin so frei (literally, I am so free) or Ich bitte, is the usual equivalent to our "if you please." Ich mache ihm meine Aufwartung, I wait upon him (literally, make my waiting upon him). Warten, when followed by the preposition auf, signifies "to wait for;" as:—Ich warte auf ihn, I am waiting for him.

2. Sollen (see § 83 [6] Remark [13]), with an infinitive, is often answered, in English, by the infinitive only, preceded by the preposition "to;" as:—Ich weiß nicht, was ich thun soll, I do not know what to do.

3. Nicht zum Worte, or, zu Worte kommen, signifies, literally, not to come to the word, or to words; that is, not to be able to speak.

VOCABULARY.

Nachen, n. Aix-la-Chapelle.	Ebenfalls, also, too, likewise.	Umsonst, in vain, vainly.
Ankläger, m. accuser, impleader.	Entschuldigung, f. excuse, apology.	Vergebens, in vain, vainly.
Aufwarten. (See R. 1. above.)	Kellner, m. waiter, bar-keeper.	Bergnügt, cheerful, merry, delightful.
Beschuldigung, f. accusation, imputation.	Kronung, f. coronation.	Vertreter, m. representative.
Bier, n. beer, ale.	Ordnung, to regulate, order.	Widerfahren, to happen, befall.
Chocolade, f. chocolate.	Tasse, f. cup, dish.	Zunge, f. tongue.

RÉSUMÉ OF EXAMPLES.

Ihr Herr Vater ist krank, nicht wahr?	Your father is sick, isn't he?
Ich wartete eine Stunde auf Sie, dann ging ich und machte dem Fremden meine Aufwartung.	I waited an hour for you; then I went and waited upon (called upon) the stranger.
Er machte mich darauf aufmerksam, daß die Zeit vorbei war.	He reminded me (made me observant) that the time was past.
Er wußte nicht, was er thun sollte.	He did not know what to do.
Die meisten Monarchen lassen ihrem Willen freien Lauf.	(The) most monarchs allow their wills free scope (course).
Der Kämmerer ließ mich nicht zum Worte kommen.	The noise did not permit me to be understood. (R. 3 above.)

EXERCISE 142.

1. Es war eine schöne Stunde, nicht wahr, mein Freund? 2. Ja, das war es, und nicht so bald werde ich sie vergeßen. 3. Nicht wahr, der Nachbar war ebenfalls auf dem Besuche? 4. Ja, er war dort, und sehr vergnügt. 5. Nicht wahr, es ist schon sehr spät? 6. Nein, es ist noch ziemlich früh. 7. Nicht wahr, es ist nicht Alles wahr, was die Leute sagen? 8. Nein, nicht Alles darf man Ihnen glauben. 9. Ich habe schon eine Stunde auf ihn gewartet, und immer läßt er sich noch nicht sehen. 10. Wir warten auf den aufwartenden Kellner. 11. Wenn Sie es erlauben, werde ich Ihnen heute Nachmittag meine Aufwartung machen. 12. Darf ich Ihnen mit einer Tasse Thee oder Kaffee aufwarten? 13. Ich danke für Thee, aber ich bin so frei, eine Tasse Kaffee anzunehmen. 14. Bei der Krönung der deutschen Kaiser zu Aachen warteten die anwesenden Fürsten auf. 15. Umsonst habe ich ihn darauf aufmerksam gemacht; er folgt nur seinem Kopfe. 16. Der Lehrer machte die Schüler darauf aufmerksam, wie wohl und gut Gott Alles in der Welt geordnet habe. 17. Der Richter fragte ihn vergebens, warum er dieses Verbrechen begangen habe; der Angeklagte hatte nichts darauf zu antworten. 18. Ich habe das Schreiben erhalten; allein ich weiß nicht, was ich darauf antworten soll. 19. Ich wußte schon, was ich darauf antworten würde, wenn ich an Ihrer Stelle wäre. 20. Die Männer, von denen Sie sprechen, sind eben nicht die besten Vertreter des Landes. 21. Ich ließ meiner Zunge freien Lauf, und erzählte das mir widerfahrene Unrecht. 22. Er ließ seiner Rede freien Lauf, und sagte in seiner Begeisterung mehr, als er hätte thun sollen. 23. Der An-

kläger ließ den Angeklagten nicht zu Worte kommen, sondern fuhr immer mit seinen Beschuldigungen fort, ohne auf die Entschuldigungen zu hören. 24. Der Kämmerer überbrachte die Stimme des Redenden, und ließ ihn nicht zu Worte kommen.

EXERCISE 143.

1. Your friend whom we saw the day before yesterday is sick, is he not? 2. It was an agreeable evening, was it not, my friend? 3. Yes, it was; and I shall never forget the pleasure we had. 4. Your brother was also there, was he not? 5. It is yet early, is it not? 6. No, it is very late, and we must go. 7. I have waited already an hour for my friend, but still he has not come. 8. I am waiting for our servant. 9. Do not wait for him, I have just sent him out. 10. After I arrived in London, I went directly and waited upon my friend, for whom I had letters of recommendation. 11. May I serve you with a cup of chocolate? 12. No, I thank you. 13. Will you not visit us before you go to the Continent? 14. Yes, I shall pay you a visit. 15. May I help you to a glass of ale? 16. I thank you, I never drink it. 17. I have heard the news, but I do not know what to say to it. 18. You speak French and German, do you not?

SECTION LXXV.—IDIOMS RELATING TO VERBS.

Schmerzen, to pain, is used like the corresponding English word; as:—Der Gedanke schmerzt mich, the thought pains me. Die Wunde schmerzt ihn, the wound pains him.

1. Weh (pain), joined with thun (to do, to make), forms the phrase Weh thun, to pain, to grieve (literally, to make, or cause pain); as:—Das thut mir weh, that grieves me (it causes me pain). Er hat dem Kinde weh gethan, he has hurt the child. Die Hand thut ihm weh, the hand pains him. Das Kind hat sich weh gethan, the child has hurt itself.

2. Leid thun (literally, to make, or cause pain) is employed to denote mental sufferings; sorrow; as:—Es thut ihm leid, daß er es gethan hat, he is sorry that he has done it. Es thut mir leid, ihn nicht gesehen zu haben, I am sorry not to have seen him.

3. Fehlen, to fail, to miss, to lack, is often used impersonally; as:—Es fehlt ihm an Verstand, he was lacking in understanding. So, also, Was fehlt dem Manne? what ails the man? Was fehlt Ihnen, what ails you, or, what is the matter with you?

VOCABULARY.

Abweichen, to deviate.	Weiten, to avoid, shun, to abstain from.	Versehen, to mis-take, to take for another.
Wiederholt, again, once more.	Nichterfahren, to defeat, discourage, dishearten.	Verstimmt, out of humour, out of tune.
Begegnen, to encounter, meet.	Path, m. path.	Vollstet, n. national song.
Ding, n. a thing.	Sagen, to say, tell.	Verfallen, to happen, to come to pass.
Erwerben, to earn, get, obtain.	Scheiden, to part from another.	Vorsichtig, careful.
Gefallen, to go wrong, to miss the way.	Schmerzen (See above).	Wahl, f. choice.
Verursachen, to cause to repent.	Serrenruhe, f. tranquillity, peace of mind.	Weh. (See R. 1. above.)
Gottlosigkeit, f. wickedness.	Streit, m. contest, contention.	Zufriedenheit, f. contentedness.
Sinzufragen, to add to, to join, adjoin.	Tugend, f. virtue.	Zufügen, to cause, to inflict.
Leid. (See R. 2. above.)	Unschuldig, innocent.	

RÉSUMÉ OF EXAMPLES.

Es fiel nichts von Bedeutung vor. Nothing important happened. Es schmerzt nichts länger und tiefer als das Bewußtsein, seine (§ 135. 4.) Jugend in Thorheiten vergeudet zu haben. Nothing pains longer and more deeply, than the consciousness of having spent one's (his) youth in folly. Sagen Sie mir, was Ihnen fehlt, und was die Ursache Ihrer Thränen ist. Tell me what ails you, and what is the cause of your tears. Es fehlt mir an Geduld, das Ende meiner Leiden abzuwarten. I lack patience to await the end of my sufferings. Ein Lobspruch, den ich mir nicht zu eigen kann, thut mir weher, als ein verdienter Verweis. An eulogium that I cannot appropriate, pains me more than a merited reproof. Mir thut das schon weh, was andern nur leid thut. That already pains me which makes others only sorry.

EXERCISE 144.

1. Es schmerzt mich, so viele Menschen unglücklich zu sehen. 2. Die Wunde schmerzt ihn mit jedem Tage mehr. 3. Es schmerzt nichts mehr

als von Leuten verkannt zu sein, deren Liebe und Achtung man sich gern erwerben möchte. 4. Es thut mir leid, ihn beleidigt zu haben. 5. Scheiden und Weiden thut weh, sagt ein altes deutsches Volkslied. 6. Der Kopf thut mir weh. 7. Es thut mir in der Seele weh, ihm nicht helfen zu können. 8. Was fehlt Dir, mein Freund, warum so traurig? 9. Es fehlt mir weiter nichts, als daß ich ein wenig verstimmt bin. 10. Sind Sie krank? 11. Ja, ich bin ein wenig unwohl. 12. Was fehlt Ihnen? 13. Ich fühle Kopfweh. 14. Sie sind reich und angesehen, und doch sind Sie niedergeschlagen,—was fehlt Ihnen? 15. Es fehlt mir viel, Zufriedenheit und Seelenruhe. 16. All (Sect. XL. 6) meine Freunde, die versprochen hatten, zu kommen, waren da, nur Einer fehlte. 17. Alle Menschen fehlen. 18. Mein Bruder ist abermals fehl gegangen; statt in mein Haus, ist er in das meines Nachbarn gekommen. 19. Seine Worte gereuten ihn, und er versprach, dieselben nie wieder sagen zu wollen. 20. Als dieses vorfiel, war ich nicht zu Hause. 21. Dieser Streit fiel in der Nähe meiner Wohnung vor. 22. Ich habe dem bereits Gefagten nur noch wenig hinzuzufügen. 23. Diefem Geschenke fügte sie ein kleines Briefchen hinzu. 24. Er fügte mir vorzüglich dieses Leid zu; deshalb kann ich ihm nicht vergeßen.

EXERCISE 145.

1. It pains a father to hear of the wickedness of his son. 2. Nothing pains more than to be accused innocently. 3. It pains me that so many persons have been found killed by the last storm. 4. I am sorry that you did not find me at home. 5. The wound which the soldier received in the contest pains him. 6. What ails you, my friend? 7. Oh, nothing particularly. 8. You look very ill, what is the matter with you? 9. I am not well, I have hurt myself. 10. He has fallen out of the window. 11. This boy lacks understanding. 12. You have been offended by me; I am sorry, for I esteem you much. 13. You dare not lack courage to encounter the contest with your enemy. 14. I lack patience to await the result of this matter.

SECTION LXXVI.—IDIOMS OF VARIOUS KINDS.

Damit (therewith) is often to be rendered by "in order to, in order that, so that," etc.; as:—Ich muß eilen, damit ich nicht zu spät ankomme, I must hasten, in order not to arrive too late. Ich wollte bitten, daß Sie das thäten, damit ich es nicht thun müßte (Geflecht), I would beg you to do that, in order that I might not be obliged to do it.

1. Seitdem = since, since then, since the or that time; as:—Seitdem sie in Deutschland war, spricht sie nichts als Deutsch, since she was in Germany, she speaks nothing but German. Seitdem ist er glücklich, since then (or that time) he is happy.

2. Gefälligst, an adverb in the superlative degree, from the adjective gefällig, pleasing, agreeable, answers to our phrase "please, if you please;" as:—Wollen Sie mir gefälligst sagen, wieviel Uhr es ist? will you please to tell me what time it is? Geben Sie mir gefälligst meinen Hut, please to give me my hat.

VOCABULARY.

Abfahrt, f. departure.	Geschwindigkeit, f. celerity, swiftness.	Seitdem. (See R. 1. above.)
Aufsetzen, to put on.	Heimath, f. home, native place.	Stürmisch, stormy.
Beispiel, n. example.	Umhängen, to hang round, put on.	Umherirren, to wander about.
Gefallen, to hasten.	Hungern, to hunger, starve.	Umwerfen, to throw round, put on.
Gefährlich, parental.	Kronen, to crown.	Verfäulen, to miss, neglect, lose.
Freigeben, to happen, occur.	Nachricht, f. intelligence.	Vertheilen, m. advance.
Erkenntniß, f. knowledge.	Pelzhaush, m. fur-glova.	Weggehen, to retire.
Fort, away. (Sect. LXXXII. 2.)	Phantasie, f. fancy.	Weggehen, to retire.
Fortgehen, to hasten away.	Reisen, m. stage-coach. [diso.]	
Fremde, f. foreign country, abroad.	Trasfen, to gorman-schweigen, to revel, carouse.	
Gefälligst. (See R. 2. above.)		

RÉSUMÉ OF EXAMPLES.

Die Deutschen können erst über die Literatur urtheilen, seitdem sie (first) judge of literature, selbst eine Literatur haben (Gefühl). since they themselves have a literature. Er ist angezogen mit dem Kleide der Gerechtigkeit. He is clothed with the garment of justice.

* Note, that gefälligst, unlike the phrase Sect. LXXIV. 1, is employed in soliciting and not in acknowledging a favour.

Der Onkel setzte seinen Hut auf und hängte seinen Mantel um. The uncle put on his hat and cloak (hung his cloak round). Er eilt heim mit sehr gerührter Seele. He hastens home with anxious soul in order that he may not miss the appointed time. (Schiller).

EXERCISE 146.

1. Seitdem ich hier angekommen bin, hat sich schon Manches ereignet. 2. Seitdem er diese That begangen hat, scheint aller Driete von ihm gewichen zu sein. 3. Seitdem er fort ist, habe ich keine recht frohe Stunde mehr. 4. Seit dieser Zeit hat man nichts wieder von ihm gehört. 5. Seit meinem zehnten Jahre habe ich das elterliche Haus verlassen. 6. Seit gestern befindet sich mich nicht ganz wohl. 7. Seit dem Tode seiner Eltern irrt er ohne Heimath in der Fremde umher. 8. Seitdem er zur Erkenntniß seiner selbst gekommen ist, ist er ein ganz anderer Mensch geworden. 9. Er zog sich in aller Geheimtheit an. 10. In der Eile vergaß er seine Stiefel anzuziehen, und eilte in den Pantoffeln fort. 11. Seine Kleider waren ganz durchnäßt, deshalb mußte er sich anders anziehen. 12. Er setzte diesen Morgen seinen Hut nicht auf, sondern seine Mütze. 13. Der Diener hängte seinem Herrn nicht, wie gewöhnlich, den Mantel um, sondern er warf ihn selbst um. 14. Vergeßen sie nicht, Ihren Mantel umzuhängen, es ist sehr kalt und stürmisch. 15. Hängen Sie mir gefälligst meinen Mantel um, und legen Sie mir meinen Hut auf, denn ich habe schon meine ricken Pelzhaushuhe angezogen. 16. Er stieg auf den höchsten Baum, damit er den König sehen könne. 17. Er war sehr eilig, damit er die Abfahrt des Postwagens nicht veräumen möchte. 18. Er erzählte mir dieses, damit ich mir ein Beispiel daran nehmen möchte. 19. Der Schüler entschuldigte sich damit, daß er keine Zeit gehabt hätte, seine Aufgabe zu lernen. 20. In großen Staaten müssen Hunderte hungern, damit Einer rasche und schnelle: Zehntausende werden gedrückt und in den Tod gejagt, damit ein gekönter Herr oder Weiser seine Phantasien ausführe.

EXERCISE 147.

1. Will you please to give me a cup of coffee or tea? 2. Since yesterday I have felt myself not quite well. 3. Since he quitted his parental house we have not heard anything of him. 4. Since the twelfth year of my age I have not visited my native land. 5. Since he received the intelligence, he has had no peace. 6. In order that my friend may not come in vain, I shall stop at home. 7. I have not seen my friend since he arrived from Germany. 8. Instead of putting on his boots, he went out in his slippers. 9. Tell your friend, if you please, he may visit us at any time. 10. Why does he not take advantage of his youth, in order to acquire the knowledge he wants? 11. How have you been since I saw you last? 12. Finish your exercise, if you have not yet finished it, then you will not be punished by your master.

SECTION LXXVII.—IDIOMS OF VARIOUS KINDS (continued).

Lieb, beloved, dear, agreeable, may, when applied to persons, be rendered (like gern with haben, Sect. XLIII. 1) "dear;" as:—Ich habe ihn sehr lieb, he is very "dear" to me. Applied to things, lieb with sein signifies to be agreeable, to please, etc.; as:—Dieses kleine Gefäß ist mir lieb, this little present pleases (is pleasing) me, or is dear to me. Es ist mir lieb, daß Sie damit zufrieden sind, I am glad (it is pleasing) that you are satisfied with it.

1. Bist auf (literally, had upon) and bist über (had over or towards) signify, "ill-disposed;" the former being applied chiefly to persons, the latter to things; as:—Warum sind Sie böse auf ihn? why are you angry at him? Er ist böse über mein Lachen, he is angry at my laughing.

2. Kennen lernen (kennen, Sect. XXV. 3) signifies "to become acquainted with." Wollen Sie ihn kennen lernen? do you wish to become acquainted with him? Ich habe ihn schon kennen gelernt, I have already become acquainted with him.

VOCABULARY.

Antreffen, to meet with.	Einführen, to usher in, introduce, import.	Schmugler, m. smuggler.
Befriedigt, satisfactory.	Gefolg, m. result.	Unmöglichkeit, f. impossibility.
Befähigen, to pacify, soften.	Gelingen, succeed.	Verboten, to forbid.
Eigensinnig, stubborn, wilful.	Wittheilen, to impart, communicate, bestow, give.	Verstellen, to represent, introduce, personate.

RÉSUMÉ OF EXAMPLES.

Es ist ihm sehr lieb, daß Sie wegen dieser Sache nicht böse auf ihn sind. He is very glad that you are not angry at him on account of this affair.

Ueber was sind Sie so böse?
Ich habe Herrn K. vorziges Jahr kennen gelernt.
Wollen Sie mich in diese Gesellschaft einführen?
Ich will Sie meinen Bekannten vorstellen.
Ich will Sie mit meinen Freunden bekannt machen.
Mein Vetter stellte den Kaiser vor.
Sein Bruder stellte mir vor, daß es unrichtig sei.

At what are you so angry?
I have become acquainted with Mr. K. (during) the past year.
Will you introduce me to this company?
I will introduce you to my acquaintances.
I will make you acquainted with my friends.
My cousin, represented (personated) the emperor.
His brother represented to me that it was wrong.

EXERCISE 148.

1. Es ist mir lieb, daß ich Sie hier antreffe; ich habe Ihnen Wichtiges mitzutheilen. 2. Es ist mir lieb, Sie so wohl zu sehen. 3. Es wäre mir lieb, Sie bald wieder zu sehen. 4. Er ist böse über das Betragen seines Neffen. 5. Er ist böse über das Ausbleiben seines Sohnes. 6. Sie ist böse über sich selbst. 7. Der Freund war böse auf mich, aber ich habe ihn wieder befänstigt. 8. Die Mutter ist böse auf ihr eigenmächtiges Kind. 9. Ich bin böse auf ihn, weil er mich beleidigt hat. 10. Kennen Sie Herrn M.? 11. Ja, ich habe ihn letzte Woche in dem Hause Ihrer Frau Tante kennen gelernt. 12. Ich lerne ihn mit jedem Tage mehr kennen. 13. Man lernt Determann eher kennen, als sich selbst. 14. Wo sind Sie mit diesem Herrn bekannt geworden? 15. Wir kennen uns von Jugend auf, und lernen uns mit jedem Tage mehr kennen. 16. Kennen Sie Frau Klein B.? 17. Nein, aber ich hoffe noch mit ihr bekannt zu werden. 18. Dieser Mann wird durch seine trefflichen Werke bald bekannt werden. 19. Herr N. stellte mich dieser Familie vor. 20. Er wurde der Gesellschaft durch seinen Bruder vorgestellt. 21. Das Neueste dieses Mannes stellt nichts vor. 22. Dieser Schauspieler stellte Karl XII. vor. 23. Durch wen wurden Sie eingeführt? 24. Ich veranste (Sect. XLIII. 6) diese Ehre der Nichte des reichen Kaufmanns. 25. Der Freund führte mich in die Gesellschaft ein. 26. Der Franzose führte diese neue Mode ein. 27. Der Schmuggler führt verbotene Waaren ein.

EXERCISE 149.

1. It would be very agreeable to me if you could leave me to myself. 2. It was very satisfactory to me to see my brother well. 3. I am very glad to hear that your undertaking has succeeded. 4. He is angry at the conduct of his brother. 5. My brother introduced me to Mr. G. 6. Has your sister already become acquainted with my brother? 7. Yes, she became acquainted with him at the last concert. 8. Do you know why your brother is so angry? 9. He is angry at me, because I laughed at him. 10. The actor personated Henry IV. very well. 11. That government has introduced good laws. 12. This fashion has been introduced by the French. 13. The import of wine from France is very great.

KEY TO EXERCISES IN LESSONS IN GERMAN.

EXERCISE 95 (Vol. II., page 94).

1. Ich schmeichle mir, daß Sie mich mit einem Besuch beehren werden. 2. Er würde mir gewiß schaden, wenn er mir beifallen könnte. 3. Der Stern der Hoffnung leuchtet dem Menschen selbst in der düstersten Nacht. 4. Ich werde meinem Freunde beistehen für die Hülfe, welche er mir geleistet hat. 5. Der Lehrer hat mir gesagt, er sei mit seinen Schülern zufrieden; sie seien fleißig, und kämen allen seinen Wünschen zuvorn. 6. Ich kenne keinen, welcher den Eigenschaften Anderer so schmeichelt, als er. 7. Es wäre zu wünschen, daß Determann den Armen beistehen möchte. 8. Schmeichle keinen Kindern nicht zu viel. 9. Napoleon sammelte die besten seiner Generale um sich. 10. Nachdem er denselben sein Vorhaben mitgetheilt hatte, erbötet sie sich ihm beizustehen. 11. Er traute seiner eigenen Macht, überzog Europa mit feindlichen Truppen, und trockte jeder Gefahr. 12. Seiner eigenen Meinung nach war seine Macht unumschränkt, und er dachte nicht der Schwierigkeiten, welche ihn umgaben.

EXERCISE 96 (Vol. II., page 95).

1. I suppose you still remember the young man who was accused of robbery last year. 2. He was accused of having robbed a rich cattle-dealer of his money on the highway. 3. But they could not convict him of this crime. 4. He had already given up all hope of an acquittal, and abandoned the idea of being declared innocent. 5. The judge, however, relieved him of all anxiety. 6. After he had told the accused man to be of good heart and cast away all sorrow, he said, "I am fully of opinion that they cannot charge this young man with the robbery." 7. For it is not every one who is ashamed of begging, and destitute of all means, that becomes a robber. 8. I can speak highly of his behaviour, for he has always been addicted to an

orderly life. 9. But I remind you of his actions in the last war, of which he may justly boast. 10. Rejoice at his acquittal, and vouchsafe him your friendship. 11. Do not scoff at him because he was in the dungeon, but rather pity him and think of his sufferings. 12. Let every one who laughs at him be ashamed of his own behaviour. 13. All present rejoiced at this speech, and they instantaneously released the accused man of his fetters. 14. Teach us thy way, O Lord! and deprive us not of thy grace. 15. I intend to visit a watering-place next summer. 16. I cannot by any means be of opinion that one should not indulge in repose after dinner. 17. He who rejoices at life should also remember death. 18. When General Tilly had conquered the town of Magdeburg, he laughed at the supplicants who besought him to commiserate them.

EXERCISE 97 (Vol. II., page 95).

1. In früheren Zeiten konnten die Leute nicht lesen, viel weniger schreiben. 2. Ich bin Willens, im nächsten Sommer die Vater Heimburg und Laubach zu besuchen. 3. Als Ludwig Philipp, König der Franzosen, seinem Throne entsagt hätte, ging er mit seiner ganzen Familie nach England. 4. Einige Könige haben wenig Ursache, sich ihrer Regierung zu rühmen. 5. Kaiser Karl V. entsagte seiner Krone und ging in ein Kloster. 6. Es ziemt einem Manne besser, auf seine Handlungen aufmerksam zu sein, als sich seiner Fähigkeiten zu rühmen. 7. Ich werde mich aller meiner Geschäfte entledigen, und ein ruhiges Leben genießen. 8. Er freute sich der Freisprechung der Unschuldigen, und wüthte sie der größten Freundschaft. 9. Die Feinde stürmten die Stadt, und lachten der Befehlenden, welche sie hatten, sich ihrer zu erbarmen.

EXERCISE 98 (Vol. II., page 118).

1. The old Saxons abjured their gods after Charles the Great had completely vanquished them. 2. Whilst he foreswore this deed with a false oath, he denied the immortality of the soul. 3. His wickedness is perceptible in his eyes. 4. I have not given up the hope of again seeing my relations. 5. I had ordered my servant to call me as soon as you came. 6. When I heard myself called, I turned back immediately. 7. If I were to imitate you, I should soon have no more money. 8. It has often happened to him already, that he looked for his spectacles and had them upon his nose. 9. The king passes through this town to-day. 10. Steer thy ship through the raging waves, courageous pilot. 11. A judicious father checks the rude behaviour of his children in time. 12. I seldom have money, but always debts; I wish I only knew how to check this inconvenience. 13. For what does it profit a man if he gain the whole world and lose his own soul? 14. His strength assisted (him) to endure these sufferings. 15. The cook tasted of the dishes. 16. It cost me liberty and fatherland. 17. It cost him his first-born son. 18. He assured me of the truth of this circumstance. 19. They secured the thief. 20. One should seek to imitate good manners.

MECHANICS.—III.

FORCES APPLIED TO A SINGLE POINT.—PARALLELOGRAM OF FORCES, ETC.

FROM the principles stated in our second lesson, it is evident that in order to ascertain when three forces applied to a point are in equilibrium, it is necessary first to discover what the resultant of any two of them is. If you find that the resultant is opposite to and equal to the third force, then you are certain of equilibrium. Before seeing how the resultant of two forces may be found, let us examine the single instance in which, without looking for a resultant, we can say that three forces are in equilibrium; that is, when three forces are all equal, and make equal angles with each other.

Take, for instance, three equal weights, attached to three strings, two of them much longer than the third, which are tied together in a knot at their other ends. If the two longer strings with their attached weights are now thrown over two pulleys in the same plane, one of the pulleys being even higher up than the other, and the third string and weight is allowed to hang down in the middle, we shall have a case of three equal forces applied to a point. There are the two outside weights acting over the pulley, and drawing the knot obliquely to either side, and the middle weight pulling it downwards. What position will the strings settle themselves into? Evidently so that the angles between the strings may be equal; for no reason in the world can be given why they should be unequal. Whatever reason could be assigned for supposing one of these angles greater than the other, that same reason should make that other angle greater than the first. The angles, therefore, must be equal.

We have next to consider how the resultant of two, and thence of any number of forces, applied to a single point may be found. You will keep in mind that by a "single point" I

mean a point "in a body," and that will save me always adding the latter words when I use the former. Of course, forces applied to "a material point" are included in the description, and these you will find to be of great importance.

As the joint effect of two or more forces so applied is termed their "resultant," so we name the separate forces of which it is the effect its components. There are thus two operations, the Composition of Forces, and the Resolution of Forces, with which we may be concerned: by the former we denote the putting together, compounding, or finding the resultant of any number of forces, and by the latter the separating, or resolving, of any given force into the two or more to which it may be considered equivalent. The Composition we first consider; but this requires a short digression on the nature of a parallelogram.

A parallelogram is a four-sided figure whose pairs of opposite sides and opposite angles are equal. In the adjoining figure, ABCD is a parallelogram, if the side AB is equal to DC, and also BC to AD. The two cross lines, AC and BD, are called the "diagonals of the parallelogram." Now, if you examine the two triangles, ABC, ADC, which are on opposite sides of the diagonal, AC, you will see reason for believing that they must be equal to each other. They are, in fact, the same triangle on opposite sides of that line; for they have AC for a common side, and the two other pairs of sides are equal, namely, AB equal to DC, and AD to BC; and you cannot out of three straight lines make two different triangles.

Now, the point to which I am trying to lead you, and which you will soon find of importance, is that, since these triangles are equal—in fact, one and the same triangle in two positions—their angles must be equal to each other. Hence we arrive at the following important properties of a parallelogram:—

1. That the opposite angles, ABC and ADC, are equal, also the opposite angles, BAD and BCD.
2. That either diagonal makes equal angles with the pairs of opposite sides, ABD equal to CDB, and ADB equal to CBD.
It is on account of this latter property the figure is called "parallelogram." The opposite sides are not only equal, but parallel, on account of their making equal angles with either diagonal. However, keep in mind that these angles are equal, for this knowledge is necessary to your properly understanding what we next come to, namely—

THE PARALLELOGRAM OF FORCES.

The forces in our cuts and diagrams being represented, as agreed on, by lines, and their directions by arrow-heads attached to their remote ends, this principle may be stated as follows:—

If two forces applied to a point are represented in magnitude and direction by two straight lines, their resultant is represented in magnitude and direction by the diagonal passing through that point of the parallelogram of which these lines are two adjoining sides.

In Fig. 2 let OP, OQ be the two forces, and draw from P and Q the two dotted lines parallel to them which meet in R, then the diagonal OR, of the parallelogram thus formed is the resultant, both in magnitude and direction, of OP and OQ.

Now, I shall not here give you the strict mathematical proof of this proposition; it is too complicated, and involves so much close reasoning, that to force it on a student in the beginning of a treatise on mechanics would be to throw an unnecessary difficulty in his way. The best course is to defer it until you have become more accustomed to mechanical reasoning, and then return to it. In the meantime you can satisfy yourselves that it is true by a reference to the two following experiments, one derived from equilibrium, the other from motion.

First Experiment.—Let three weights, u , v , w , be attached to three cords, as in Fig. 3, which are knotted together at o ; and let two of the cords, longer than the third, with their at-

tached weights, be thrown over two pulleys, P, Q, which move freely in the same plane round axes fastened into a wall or upright board. Arrange, then, the weights and cords until equilibrium is produced. It is evident, from the principle stated at the close of the last lesson, that the force, w , must be equal and opposite to the resultant of u and v , acting over the pulleys at o . Now, take on the cord o , a length oA , equal in inches to the number of pounds in u , and on o another, oB , equal to the pounds in v , and then draw the parallels, A and B , to o and o , meeting in R ; oR will then be the resultant of u and v , if the principle of the parallelogram of forces be true. It should, therefore, be opposite in direction to the force w , and the number of inches in it should be equal to the number of pounds in w . Now, on trial it is found that oR is opposite to w , that is to say, that it points vertically upwards in the plumb-line; and it is also found that the number of inches in its length is that of the pounds in w .

Second Experiment.—Let us suppose that a parallelogram $oARB$ is described anyhow on a perfectly smooth horizontal table, and that at the point o , two springs are fitted so that one of them, on being let go, would make the unit ivory ball move over oA in the same time that the other would make it move over oB . It is evident that the lines oA and oB would then represent these forces. Furthermore, it should follow, if the principle of the parallelogram of forces be true, that, when both springs are let go together so as together to strike the ball, it should move over the diagonal oR of the parallelogram in the same time as the ball moved over oA and oB when struck separately. Now, this is what, on trial, exactly happens. The ball does move over the diagonal, and moves over it in the same time that it previously moved over the sides. This it could not do if the resultant of two forces was not represented in magnitude and direction by the diagonal. Instruments are fitted up for lecture-rooms by which the experiment can be made, and the result always is as I have stated.

Taking the principle, then, as established, let us observe its consequences. You are given two forces, acting at a point, and you want their resultant. Make, you will immediately say, a parallelogram of the two forces, and the diagonal is the required line. Not so fast; you need not describe the whole of that figure, a part will suffice. Now, if from the end A of oA , you draw AR parallel and equal to oB , it is clear you do not want to draw BR at all. AR gives you the far end of the resultant, and all you have to do then is to join R with o , and your object is gained. Thus your parallelogram of forces suddenly becomes a triangle of forces; and you may lay this down as your rule in future for compounding two forces.

Draw from the extremity of one of the forces a line equal, and parallel to, the other force; and the third side of the triangle so formed by joining the end of this line with the point of application is the resultant. There is great advantage in this substitution of the triangle for the parallelogram, for it saves the drawing of unnecessary

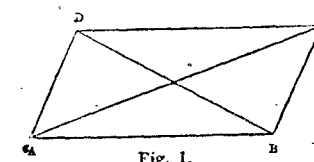


Fig. 1.

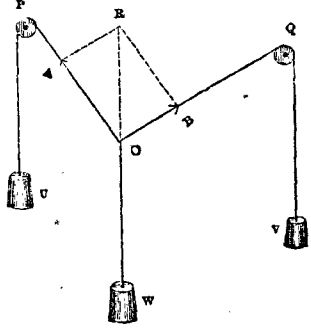


Fig. 3.

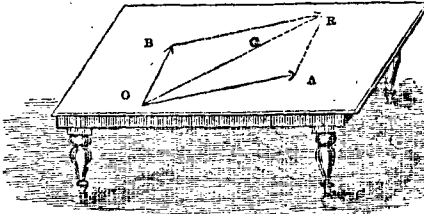


Fig. 4.

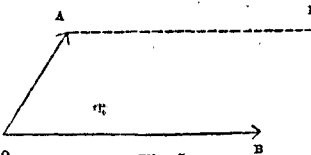


Fig. 5.

lines, which, as you will see, when many forces have to be compounded, would cause much confusion in your figures.

Let us apply this principle now to compound any number of forces acting on a point. Let there be five, and that will illustrate the rule as well as a thousand could. Suppose forces, $O A$,

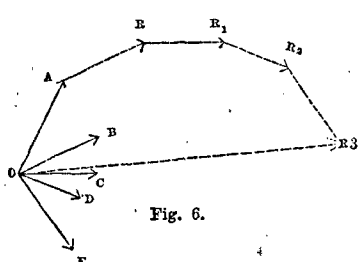


Fig. 6.

applied to the point, O . By the triangular rule, if I draw $A B$ equal and parallel to $O B$, the line joining O with B is the resultant of the first two forces. I shall not actually draw this line, $O R$; let us suppose it drawn. Now, if I compound this resultant with $O C$, I have the resultant of three of the forces. But that, by the same rule, is got by drawing from R a line $R B$, equal and parallel to $O C$. The line $O R$ is this resultant of three. Again we shall not draw it. The resultant of this and $O D$, for the same reason, would be $O R$, got by drawing $R_1 R_2$ parallel and equal to $O D$, and, lastly, the resultant of this and $O E$ would be $O R$, the line, $R_2 R_3$, being equal and parallel to $O E$. We have thus exhausted all the forces, and evidently $O R$ is the resultant of the whole five. There was here no confusing ourselves with parallelograms; all we had to do was to draw line after line, one attached to the other, carefully observing to keep their magnitudes and directions aright. A kind of unfinished polygon was thus formed, and the line $O R$, which closes up the polygon, joining the last point R_3 , with the point of application, is the resultant in magnitude and in direction. Thus you have made another step in advance, and arrived at the Polygon of Forces. You have learned how, by the mere careful drawing of lines, to determine the resultant of any number of forces. All you require is paper and pencil, a ruler, compasses, a scale, and a pair of parallel rulers.

Now, there is one point about this polygon I wish you carefully to note. You will observe that the arrows on its sides, representing the directions of the forces you have compounded, all point from left to right, as you go round the figure, turning it with you so as to bring each side in succession to the top. The resultant, however, points in the opposite direction, from right to left, when that side is uppermost. This is as it should be; the direction of the resultant, as you go round the figure, must be opposite to those of the components. The use of this you will see in the next lesson.

Now, let us suppose that, in determining the resultant after this method, as we come to the end of the operation, the end, R_3 , of the last line, $R_2 R_3$, chanced to coincide with, or fall upon the point of application, O . The polygon would close of itself without any joining line; what is the meaning of this? It means that there is no resultant; the line, $O R$, is nothing, and therefore the resultant is nothing, and the forces produce equilibrium. What a valuable result we have arrived at! A method by which we can, by rule and compass, tell at once whether any number of forces make equilibrium at a point or not. All we have to do is to describe the polygon of forces, and if it closes up of itself, there is equilibrium; if it does not, there cannot be equilibrium, and the resultant is in magnitude the side which is necessary to close the figure.

Deferring the further expansion of this subject for a short time, I shall now turn back and apply these principles to a few elementary examples.

First Example.—Three equal forces act at a point in different directions—what condition should they fulfil in order to be in equilibrium? Get your ruler and compass, and commence constructing the figure by which their resultant may be found. From the end of one of the forces you are to draw a line equal and parallel to the second equal force, and from the end of that another line, equal and parallel to the third. You will thus have three lines strung together, all equal to each other. But if the forces are in equilibrium, the end of the last line must fall on the point of application, that is to say, the polygon of forces must close up, and form a triangle. Your construction will then give you a triangle of three equal sides, commonly called an equilateral triangle. But such a triangle must have

all its angles equal; also the angles between the sides of the triangle, or of the polygon of forces, are the angles between the forces themselves, since they are parallel to these forces. This is evident from the properties, 1 and 2, of the parallelogram referred to above; therefore, in the case we are considering, the three equal forces must act at equal angles, as I showed other-wise must be the case at the close of the last lesson.

Second Example.—Let a weight hang from the ceiling by means of two cords of unequal length, as in Fig. 7. It is evidently at rest. Whatever be the forces called into action, they produce equilibrium. Is there nothing further to ascertain? There is; it may be desirable to know by how much each cord is strained. Our assurance that the cords will support, the weight depends on this knowledge. Let P and Q be the two points of support of the strings which meet at O . Now, whatever be the strains on the cords, $O P$, $O Q$, they make equilibrium with w , the weight. Therefore, if we suppose a length, $O A$, of $O P$ to represent the strain on $O P$, and from A draw a line, $A R$, parallel to $O Q$, equal to the strain, $O B$, on $O Q$, then, since the three forces are in equilibrium, the line, $R O$, closing up the triangle must be equal to, and be in the direction as, the third force, or weight, w . This, then, tells us what to do. Measure on $O R$ upward as many inches as there are pounds in w ; and from R then draw $R A$ parallel to the cord $O Q$ to meet the cord $O A$. The number of inches in $O A$ will represent, in pounds the strain on $O P$, and those on $R A$ the strain on $O Q$. All, therefore, that we desire to know is determined.

Third Example.—A horse pulls a roller up a smooth inclined plane or slope; what is the force he must exert when he just keeps the roller at rest? And by how much does the roller press on the plane?

Let the horse pull in any direction, $O A$. Then there will be three forces acting on the roller; namely, its own weight right downwards, the horse's pull, and the resistance of the plane or slope, perpendicular to itself. There must be this third force, for the other two, not being opposite to each other, cannot make equilibrium. The roller is somehow supported by the plane; and that it cannot be unless by its resistance; and a plane cannot resist except perpendicularly to itself. This third force, you thus see, must be taken perpendicular to the plane. It is represented in the figure by $O B$. Now apply the polygon of forces. Let $O C$ represent the weight of the roller, and from C suppose a line, $C R$, drawn equal and parallel to $O A$, the horse's pull. Then, since there is equilibrium, the polygon of forces should close up and become a triangle—that is, the line joining R with O should be the pressure, and therefore should be perpendicular to the plane. What then are we to do? Take $O C$, equal in inches to the number of pounds in the roller, draw then from C a line $C R$ parallel to the horse's pull, to meet the line drawn from the centre O of the roller perpendicularly to the plane; $C R$ so determined will in inches tell the pounds in the horse's pull, and $O R$ the amount by which the roller presses the plane. You can easily see from this that as the slope increases the pull will increase and the pressure diminish. This is what naturally we should expect. The plane I have supposed to be smooth; for, where there is friction against the roller caused by roughness in itself or in the plane, or in both, the question is much altered, as in due time you will see.

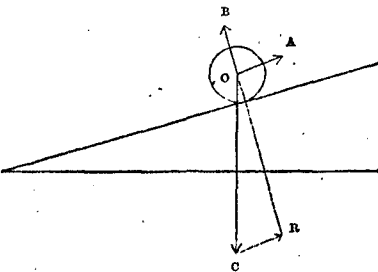


Fig. 7.

Fig. 8.

THE TWISTED POLYGON.

The method of finding the resultant of several forces holds good, whether they act all in the same plane, or some of them upwards or downwards from it in different directions. For example, five forces, represented by the lines, $O A$, $O B$, $O C$, $O D$, $O E$, in Fig. 9, are thus applied to a point O of a body on the floor of a room; two of them, $O A$, $O D$, along the floor in two different directions; another, $O B$, pointing to a picture on the left wall; a fourth, $O C$, to the cross on the top of a steeple, seen through the open window; and the fifth and last, $O E$, obliquely downwards, pressing the body against the floor. On constructing, in such a case, the polygon of forces, we should have the figure as represented in perspective below, one of whose sides, $O A$, is on the floor, while the others, $A R$, $R E$, $E_1 R_1$, $R_1 R_2$, and $R_2 R_3$, are in the air. A figure of this kind is termed a *twisted polygon*, as though its sides had been all originally in the same plane, but, by a twist, some of them had been pulled from it. You can see that, since such a polygon cannot be drawn on paper, so as to have the magnitudes of its sides and angles there accurately represented, it can be of no practical use in finding resultants. You might make one by fastening five rods of the proper lengths together at the proper angles, but the structure would probably break down before you arrived at your resultant, and at the best the operation would be very troublesome. Calculation alone can help in such cases; but

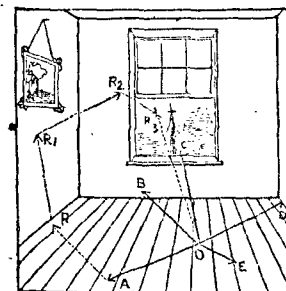


Fig. 9.

the "twisted polygon" has the educational value of giving the student mechanical ideas.

EXAMPLES FOR PRACTICE.

- Three forces act on a point $O A$, equal to 3 pounds, $O B$ to 5, and $O C$ to 7. The second lies between the other two, making with $O A$ an angle of 30 degrees, and with $O C$ 45 degrees. Find the pounds in the resultant, and the angle it makes with the least force $O A$.
- A roller of a hundred weight is supported on an incline, the gradient of which is one foot in two, by a force which acts along its slope. Find the magnitude of this force and the pressure of the roller on the plane.
- From two points on a ceiling, five feet apart, a sixty-pound weight is suspended by two strong cords, which meet at the point of suspension. The lengths of the cords are three and four feet respectively. Find the magnitudes of the forces by which they are strained.
- Three weights of three, four, and five pounds are attached to three cords, which are knotted together at their other ends. The two cords bearing the lesser weights are thrown over two pulleys fastened at a distance of 10 feet from each other, and at the same height, into a wall, the greatest weight hanging between them. Find the position in which the cords and weights will settle into equilibrium.

You will observe that these problems are to be done by rule and compass, etc. We have not yet come to the more effective method of solving them by calculation. The geometric way, however, of drawing and measuring is the best for giving you accurate ideas of the subject, and therefore indispensable in the first stages. The lines you must carefully lay down by a ruler, and the angles by a circular protractor, keeping in mind, as to the latter, that in every right angle there are ninety degrees. The distances representing the forces you must take from an ordinary scale; and observe, as to this, that you need not make in every case your drawings so large that a whole inch be given to every pound of force. You may allow a quarter of an inch to each pound, or hundredweight, or ton, or even a tenth, if the numbers be large. All that is necessary is to keep the proportion of your figures right, whether they be on a large or a small scale, as is done in mapping or drawing plans of buildings. For the above examples a scale of a quarter of an inch for each pound will be quite sufficient. Perhaps for the third example tenths of an inch will best answer. In another lesson the answers to these problems will be given.

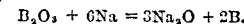
LESSONS IN CHEMISTRY.—XVII.

BORON—SILICON—THE METALS.

BORON (SYMBOL, B; COMBINING WEIGHT, 11).

Boron and silicon are often classed with carbon, for each of these elements is capable of being produced in three states—amorphous, crystalline, and crystallised.

The element boron is procured by the action of sodium on boric acid, thus—



Thus obtained it is a dull greenish powder, slightly soluble in water, from which solution it is precipitated unchanged by sal-ammoniac. It does not oxidise in the air, but readily with nitric acid. At a very high heat it takes fire, burning into boric acid (B_2O_3).

The other two kinds of boron are exhibited by its action on melted aluminum.

The crystals of boron are as hard as the diamond.

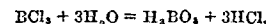
Boric Acid (B_2O_3).—At Monte Cerboli and Monte Rotondo, in Tuscany, exist "fumeroles," that is, jets of steam escaping from the ground. This steam is mixed with sulphuretted hydrogen, but holds in solution free boric acid. The vapour is directed into small lagoons, where it is condensed, and upon evaporating the water crude boric acid is obtained, which is the chief source of the borax of commerce. This acid combined with soda is found in the *tincal* from Thibet, and a borate of lime and magnesia exists on the west coast of South America.

Boric acid imparts a green tint to the flame of alcohol. Its great value lies in the fact that it imparts to its salts ready fusibility; hence in the manufacture of porcelain and in metallurgy borax is used as a flux.

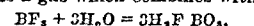
The crude boric acid, procured as above, is really the hydric borate or $3H_2O.B_2O_3$, which is usually written H_3BO_3 .

Borax is the baborate of soda.

Boric Chloride (BCl_3). is obtained by passing dry chlorine through a red-hot porcelain tube containing a mixture of boric acid and charcoal. It is a gas which condenses into a mobile liquid below $18^\circ C$. It is decomposed by contact with water, thus—



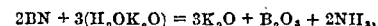
Boric Fluoride (BF_3). is procured by heating fluor spar and boric acid. It is a gas which combines with water, thus—



forming hydro-fluoro-boric acid.

Boric Sulphide (B_2S_3). is produced when boron is burnt in sulphur.

Boric Nitride (BN).—Like titanium, boron combines with nitrogen at a red heat, forming a white powder, which has a "greasy" feel. When melted with potash it becomes ammonia and boric acid, thus—



and when heated in a current of steam it is resolved into ammonium borate.

SILICON (SYMBOL, Si; COMBINING WEIGHT, 28).

In combination with oxygen as silica, this element is one of the chief components of the earth's crust. It may be isolated by submitting a mixture of equal weights of potassium and the fluosilicate of that metal to a red heat in a platinum crucible. Silicon and potassium fluoride are the result, and the latter is washed out by water.

Thus obtained, it is a brown amorphous powder. When heated in oxygen it becomes silicic acid.

No acid affects it except hydro-fluoric, by which action the tetrafluoride of silicon is formed, as was noticed, in the etching of glass.

The "graphitoid" and crystal forms of silicon have been obtained.

Silicic Acid (SiO_2 , silica, or silicic).—It corresponds in its composition to carbonic dioxide (CO_2). It is found pure in quartz, when it appears as rock crystal; it is nearly pure in flint, chalcedony, agate, opal, etc., and it constitutes the main ingredient of all sandstones. Silicic acid can only be fused by the oxy-hydrogen blow-pipe. Water has no action on it; but with steam at a high temperature, it seems to be dissolved. This accounts for the concretions of silicic acid in the throats of furnaces. However, it can be rendered soluble. If rock crystal be heated to redness, and then suddenly cooled in water, it can be easily

reduced to powder in an agate mortar. An alkaline silicate is formed when this powder is heated with three times its weight of sodium or potassium carbonate. If this be added to an excess of diluted hydrochloric acid, the acid combines with the metal, and although the silica is thus ejected from its combination, it does not precipitate; but if heat be now applied, when the solution has reached a certain point of concentration, the silicic acid is again rendered insoluble, and becomes a gelatinous mass. By still continuing the heat until much of the water is driven off, then the chloride of the metal may be washed out, and the pure silicic acid remains in its insoluble form. When rendered anhydrous, it is a white, light powder.

All spring or well waters contain silica, either in a free state or in solution as an alkaline silicate, and by this means it enters into many vegetable and animal organisms.

Silicon Chloride (SiCl₄).—As the corresponding boron compound, this is got by heating silica mixed with carbon in a current of chlorine. It is a liquid, and has the same remarkable action with water as the boron chloride, being decomposed into hydrochloric acid and silicic acid.

Silicic Fluoride (SiF₄). is the gas by the formation of which, with hydrofluoric acid, the etching of glass is effected.

There is also a *sulphide of silicon*, which is a solid. When thrown into water it decomposes, sulphuretted hydrogen escapes, and soluble silicic acid is taken up by the water.

METALS.

GENERAL PROPERTIES, ETC., OF METALS.

It was stated in an early lesson that the distinction between a metalloid and a metal was not very decided. Perhaps the definition of a "metal," which will be finally adopted, will be that it is "a body which, when in solution, is carried with an electric current which traverses that solution;" but on referring to the analysis of water by the voltameter, it will be noticed that hydrogen passes with the current; hence it is necessary, if this definition be adopted, to class that gas among the metals. There is no reason for doubting that if hydrogen could be condensed into a solid it would exhibit metallic lustre and the other properties common to all metals.

The chief properties which characterise metals are—

Metallic Lustre.—This lustre, however, is not peculiar to the class, for it is shared by iodine and graphite.

Moreover, if most metals be procured in a state of fine subdivision they are lustreless. This is prominently the case with gold, which, when painted on china, in a chemical solution, and then burnt, comes out of the furnace dull green, and the well-known lustre of gold does not appear until the painted portions have been burnished.

Opacity.—Metals are usually considered opaque, but this is not absolutely true, for gold, if not more than $\frac{1}{1000000}$ th of an inch thick, permits green light to pass through it, and other metals exhibit a similar imperfect opacity when reduced to very thin leaves.

Hardness.—Steel, which is a compound of carbon and iron, is the hardest of the metals, and the rest pass through every degree down to potassium, which may be moulded by the fingers as if it were putty. The hardness of a metal may be greatly increased if its temperature be raised to a certain point and then suddenly cooled by plunging it into water. Many of the hard metals are sufficiently elastic to be sonorous when struck.

Brittleness and tenacity are closely connected. Many of the metals, such as bismuth, antimony, arsenic, are so brittle as to admit of being pounded in a mortar, and many, such as steel, iron, copper, can be made brittle by suddenly reducing their temperature. Others, again, exhibit this quality only at certain temperatures: for instance, zinc, which cannot be bent without danger of cracking, is readily worked at a temperature of about 115° Cent.; and on the other hand, brass—an alloy of zinc and copper—becomes brittle as it approaches a red heat.

Tenacity is the property which gives to metals their power of supporting a strain. Iron possesses it in the most eminent degree, hence the great value of this metal.

Malleability and Ductility.—Possessing the one property, the metal may be beaten or rolled into very thin leaves; with the other, it admits of being drawn into wire. Gold, silver, copper, and platinum are very malleable. Gold may be beaten out into leaves so thin that 280,000 only make an inch. These metals, and iron, are the five which are notably ductile. Wollaston, by

placing a wire of platinum in the axis of a bar of silver, and then in the usual way—that is, by drawing it through holes in a steel plate—procured a very fine wire, the centre of which was one much finer of platinum. By dissolving the silver away with nitric acid, this was exposed, and found to be $\frac{1}{1000000}$ th of an inch in diameter. The foregoing qualities are greatly dependent on the texture of the metal, and the dissolving texture is greatly affected by the manipulations which the metal undergoes in its reduction from the ore. Thus cast-iron is brittle, so is hard steel; yet steel is capable of being made into watch-springs, and iron can be drawn into very fine wire.

Specific Gravity is the relation which the weight of a body bears to the weight of an equal volume of water. The metals differ greatly in their specific gravities:—

Platinum, 21.5.	Silver, 10.53.	Arsenic, 5.96.
Osmium, 21.4.	Bismuth, 9.79.	Aluminum, 2.56.
Iridium, 21.1.	Copper, 8.95.	Magnesium, 1.74.
Gold, 19.34.	Cobalt, 8.85.	Sodium, 0.972.
Mercury, 13.59.	Iron, 7.84.	Potassium, 0.865.
Lead, 11.36.	Tin, 7.29.	Lithium, 0.593.
	Zinc, 7.14.	

The lightest metals are the most easily attacked by oxygen.

Fusibility.—The following table gives the "melting points" of the chief metals:—

Mercury, 39° 4' Cent.	Tin, 229°.	Copper, 1091°.
Potassium, 58°.	Lead, 325°.	Gold, 1102°.
Sodium, 97° 6'.	Zinc, 412°.	Cast-iron, 1530°.
	Silver, 1023°.	

while platinum requires the intense heat of the oxy-hydrogen blow-pipe.

Volatility is the property which some metals exhibit of going off in vapour at certain temperatures. Mercury, arsenic, tellurium, zinc, cadmium, potassium, sodium, can all be distilled from their compounds.

Alloys.—When metals enter into combination, "alloys" are formed. The union is now generally considered to be "chemical." The various alloys will be treated of under their metals. An "amalgam" is an alloy in which one of the metals is mercury.

The Appearance of Metals in the Earth's Crust.—Gold, platinum, silver, mercury, and copper are found "native"—that is, in an uncombined form; but the last-named three are also found as ores. Next to silica, metallic oxides are most widely distributed in nature. Lime is the oxide of calcium. The tint of the sandstones is due to the oxide of iron. The granite rocks contain many oxides, while the waters of the ocean are rendered briny with their salts. But the metals which we require in large quantities we seek from masses of their ores, which are found in *mineral veins*. It often appears that the older rocks have, in the convulsions of Nature, been rent into fissures. When these openings have not been filled up from below with molten basalt, trap, etc., thus forming *dykes*, they have been filled up with metallic ores, which seem to have been usually deposited from above. These constitute "lodes." The lodes of a neighbourhood generally run in the same direction, and, strange to say, if this direction be altered, the ore generally alters its character, and frequently its chemical constitution. This and other reasons have led to the belief that electricity has been the chief agent in depositing metallic veins. It sometimes happens, as in the case of the iron beds in our own country, that the ore is found in strata, occupying the position of a layer of rock.

DIVISIONS OF THE METALS.

1. Metals of the Alkalies.

Potassium.	Sodium.	Lithium.
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2. Metals of the Alkaline Earths.

Barium.	Calcium.
Strontium.	Magnesium.

3. Metals of the Earths.

Aluminum.	Erbium.
Glucinum.	Terbium.
Zirconium.	Cerium.
Thorium.	Lanthanum.
Yttrium.	Didymium.

4. The Metals Proper.

The last division is subdivided into classes of metals which exhibit certain similar features.

SKETCHING FROM NATURE.—I.

MATERIALS—CHOICE OF SUBJECTS, ETC.

IN our Lessons in Drawing, to be found in the previous pages of the POPULAR EDUCATOR, we have endeavoured to place before our pupils the general principles which belong to and are applicable to the practice of drawing from the *flat* (that is, from copies), and also those principles which guide us in drawing from the *object*. We now undertake a more direct application of the instruction therein given, for the purpose of introducing our pupils to that very interesting and delightful practice of drawing, usually termed "sketching from nature;" we mean by this, the taking up a few simple materials and seeking our subjects out of doors. The phrase "sketching from nature" is a very convenient one, and is generally understood, therefore

whether it is easier or more difficult depends upon the inclination of the mind, the practical experience, or, speaking more exactly, the *kind of experience* the pupil has been accustomed to. If the grammar of the art has been well learned, the pupil will find that a very considerable amount of the knowledge he has acquired whilst drawing from the *flat* will be of the greatest service when drawing from nature.

We have frequently met with portrait painters who have had to make duplicates of their pictures, and who have said they would much rather paint them again from the sitter than copy them from the original picture: only those who have experienced it can fully understand how much more feeling and life can be imparted to the work when nature is the guide, than when they have to depend upon the limited expression of a copy. So with landscape: we have frequently been more pleased with the

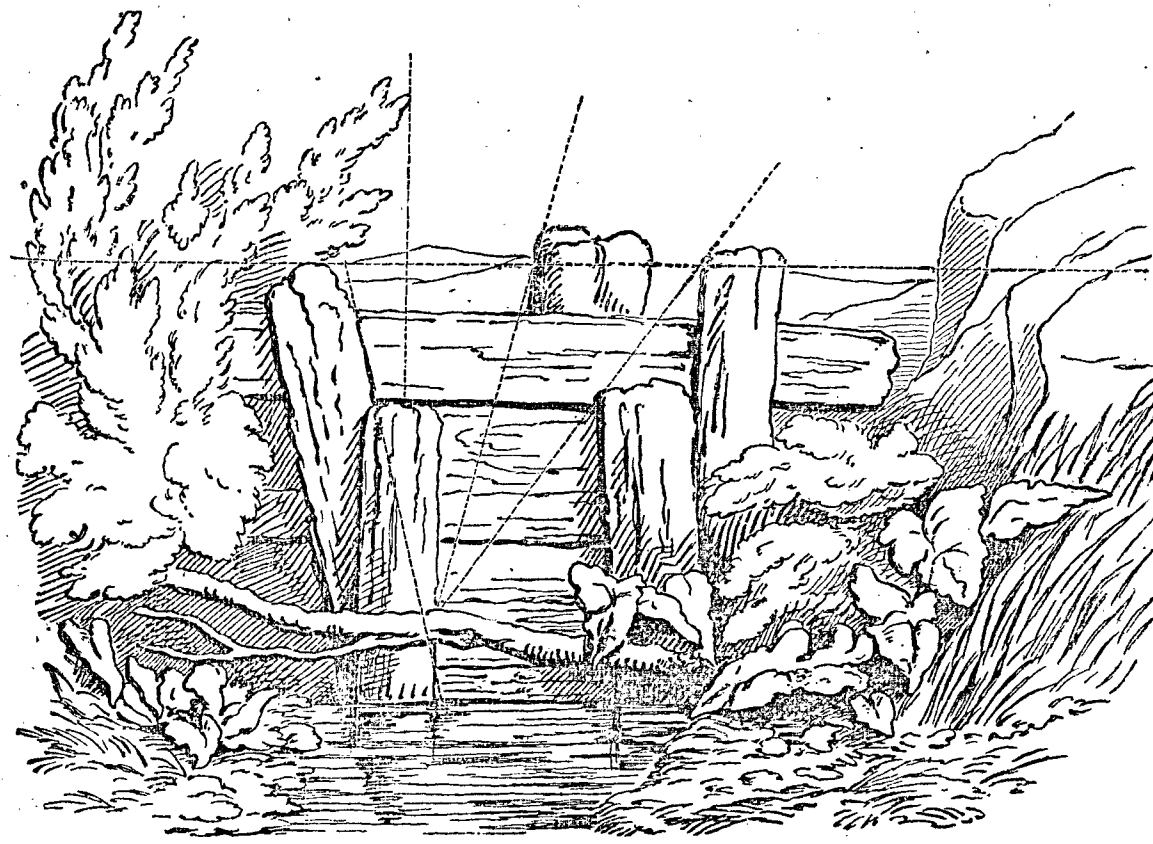


Fig. 1.

we still retain it, although we prefer the expression "drawing from nature," as it implies greater care and attention to details than the term *sketching* in its usual sense. A loose habit of drawing may be called sketching, and if this were all that is understood by it, the practice would be a dangerous one for a beginner; but as we have already given sufficient cautions upon this point in the lessons upon Drawing, we will only repeat one piece of advice and pass on—"Learn to draw first; sketch afterwards." In the course of these lessons we shall find it necessary occasionally to refer back to the lessons in Drawing already given, as our object is to apply practically the principles which have been there stated. How many times has the question been asked, "Do you draw?" And what is the reply in the great majority of cases? "Yes, but only from copies; I have never attempted to do anything from nature, having always considered it so much more difficult." Now, there are those who maintain the reverse, namely, that drawing from nature is easier than copying pictures. Certainly the former is much more pleasant, and more satisfactory, as all must acknowledge;

"original sketch," taken upon the spot, than with the finished picture painted from it in the studio at home. Although the "original sketch" was not so highly finished as the picture, yet it had the stamp of nature and freshness upon it, which could best be caught from the scene itself, and which it is difficult to impart at second hand. As the eye of the student becomes more and more accustomed to Nature, and keener to detect and appreciate her beauties, he will discover much of which a common observer has but an imperfect perception; to the latter, a landscape is the same to-day as it was yesterday, he can only see trees, buildings, and other objects abstractedly through one and the same medium; while the eye of the artist is continually discovering something fresh, perhaps principally caused by the successive changes of light, or from the positions of objects in relation to each other, and their contrasts in both colour and form. The tree before him in the morning may certainly be the same that he sees in the evening, but how very different is the effect, and what a multitude of details with all their beauties, which were imperceptible in the morning, are

brought out by the change of light. We have no doubt that many of our pupils, when they have conquered their early difficulties, will discover with pleasure and surprise that drawing from nature has a charm about it which cannot be realised by copying only.

The necessary materials are simple:—A block, that is, a solid mass of paper composed of several layers bound together only at the edges, so that when a drawing is completed we have only to slip a penknife between it and the next paper, pass it round, remove the drawing, and underneath will be found another surface like the one already filled, ready for use. The kind of paper for pencil drawing ought not to be very rough, a slight grain will assist the pencil to mark freely, but on very rough paper it is impossible to give a very high finish to the work; rough papers are better adapted for colours. A few pencils, H, HB, and B, and a portable sketching stool, will be all that is requisite for our first essay. Being now prepared, let us suppose that we are on our way in search of a subject, and in the meantime we will make a few observations which especially apply to beginners. No one who has been accustomed to copy pictures only, can altogether comprehend what a very different thing it is to draw from nature until he has made the attempt, when he will discover there are several reasons for the difference. One is, that all the objects in the picture are reduced for him, probably to the exact size he wishes to make them; another is, the outline upon the paper has a more definite effect than the general form in nature, which admits of no actual boundary line, but presents only the mass discoverable from other objects by colour, and light and shade; another reason is, that objects in nature advance or recede from one another, whilst in a picture they are all arranged upon one plane or surface; and thus we are led to acknowledge the necessity of knowing something both of lineal and aerial perspective. It is true many depend upon the eye alone for the proportions of the retiring parts as they recede, and consequently are liable to make frequent and serious mistakes, which a little acquaintance with perspective would prevent; but we intend to take up this part of our subject again.

We will now pass on to another consideration with reference to the choice of subject for the first attempt of a beginner. We well know the feelings with which most beginners go out for the first time to draw from nature; their enthusiasm would persuade them to attempt great things; nothing short of some extensive prospect, hill and dale, woods, rivers, buildings—in short, a whole country side. Upon this point we wish to caution our pupils. It is one of the first and greatest mistakes which young painters make when they begin to draw from nature; nearly all, without exception, sit down to take some extensive view, without a question as to its composition, and without any inquiry whether they will be able to go through with it. The principal reason they give for their choice is "the beauty of the scene." We knew a case some years ago of a young student in the Royal Academy, who copied in the painting school an elaborate landscape by an old master; succeeding beyond his expectations, he felt a strong desire to paint a picture from nature, having now, as he thought, acquired sufficient power to justify the attempt. Accordingly, he went to the top of Highgate Hill, and commenced a picture of the entire prospect looking northward; he worked hard for several days, but found he was alternately painting in and rubbing out; the constant changes of sunshine and shade, as they passed over the landscape, perfectly bewildered him, and the result was that he gave it up quite disheartened. He resolved, however, to show the little he had done to the late Mr. Constable (the painter of "The Corn-field" in the National Gallery), and ask his advice. Mr. Constable looked first at the picture and then at the youth, and in a quiet way, though with unmistakable meaning, said, "My young friend, go and draw a gate-post, and when you have done that draw two posts, and go on till you can manage a dozen; afterwards add a cottage, then a tree, and proceed in this way until you have power to do something more elaborate before you think of painting such a subject as this. You have made precisely the same mistake that I made when I was your age; you have begun at the wrong end."

The above excellent advice needs very little comment from us. It is exceedingly valuable, and forcibly suggests the folly of rushing headlong into a multitude of difficulties from which

there is no escape, but at the cost of much discouragement. All must acknowledge that, whatever may be the extent of the subject they propose to draw, it is essentially composed of several particular objects, each of which requires a separate and careful study. Now the first question every one must ask himself should be, "Can I copy any one of these objects, independently of the rest?" If he cannot, let us assure him it would be useless to attempt the whole together. All who have reached any eminence in the art have found from experience the advantage of overcoming the difficulties connected with single objects first. Our pupils will clearly see from these remarks that the simpler the subject the better for a first trial, so that as their strength and confidence increase they will find themselves capable of enlarging their subjects, of entering more closely into their numerous details, and as they proceed a proportionate amount of increasing satisfaction will be gained, and the art itself will become more and more interesting.

Fig. 1 will give some idea of the class of subject for a first attempt, and the manner of treating it, which need not be much beyond a carefully arranged and cleanly drawn outline; the shadows might be slightly marked in by a few parallel lines under the projecting parts, down the shadowed sides of the posts, to define and to bring forward the branch of a tree. In this simple arrangement of a few posts and weeds, there are no important retiring lines, consequently there will be no necessity for vanishing points, a subject for our consideration in another lesson. The distance of the station point, or the position of the draughtsman from an object of this class and extent, might be about a dozen or fourteen yards, because at that distance all contained within its outer limits will be considerably within an angle of 60°. See "Lessons in Drawing," Fig. 25, and the remarks upon it (Vol. I., page 72). Subjects of the class we have selected are very common: a stile, a bridge over a brook, and many more of the same kind, are to be found almost everywhere. We have just said that the drawing need not be more than a carefully arranged outline. If for some time the pupil will confine himself to outline, and use no more shadow than is necessary to assist in making the form clear and intelligible, it will be an advantage, because it is doing one thing at a time, and he is not overpowering himself with difficulties; besides, shading bad outlines is a waste of time, as shading cannot improve the drawing, nor can it be successfully practised without the power of correct drawing, as it is only an additional help to represent the form marked out by the outline. There are other important considerations to be attended to. The pupil must remember, when he is seated, that the few moments before he puts his pencil on the paper are very important. First, he must decide how much of the subject he intends to draw; that being determined, he must fix upon the centre of the subject to be arranged in the centre of his paper, and as in most cases the eye will be considerably below the centre, there will then be sufficient room for the sky above, and the foreground below the object. Probably a single trial will induce him to make this a general rule until experience has taught him to arrange this matter for himself according to his position and the nature of the subject he is drawing. The next piece of advice we would give him before he begins, is to fix his whole attention upon what he is about to draw; he must examine not only of what it is composed, but he must attentively observe how the several parts are arranged with regard to each other, and what are the rules and principles he has at command for his purpose. As he is about to draw it as it appears to him, without attempting any effect which does not strictly belong to it, he must take up one principle at a time; the first will be form—this refers, in the first instance, to the shape and character of the subject as a whole; then the position of the parts relative to each other; all important particulars must be carefully examined, his eye and his mind must become familiar with everything; this will strengthen his confidence, so that when he begins to draw, the acquaintance he has made with his subject will be of the greatest value. In practice, it is quite allowable to determine the relative heights of the parts with one another by placing the pencil horizontally before the eye, having its edge on a level with any particular point, and by looking along the remaining portion of the pencil when thus placed, the pupil will be able to see at once which other portions are on the same level, which are above, and which below; he must notice where lines if produced would cut other lines already drawn, and also where

one part is over or under another. We have drawn dotted lines in the illustration (Fig. 1) to show the various directions in which the pencil might be held between the eye and the object, and the result it gives in deciding how the parts are placed in connection with each other.

LESSONS IN ARITHMETIC.—XXXIX. FELLOWSHIP, AVERAGES, MIXTURES IN CERTAIN PROPORTIONS, ETC.

1. If several partners have invested different sums in an undertaking, it is manifest that the profits or losses must be divided among them in proportion to the capital each has invested in the business, if the capital of each has been in use for the same time.

The method by which the share of each is determined in this case is called *Simple Fellowship*. It is manifestly the same as that given in Lessons in Arithmetic, XX., on Ratio and Proportion, Arts. 7, 8 (Vol. I., page 343), where a given number is divided in proportion to certain others.

EXAMPLE.—A, B, and C put into a business £300, £500, and £800 respectively. At the end of a year they have gained £400. What is the share of each?

We have to divide £400 in the proportion of 300, 500, 800, or, what is the same thing, in the proportion 3, 5, 8.

According to Lessons in Arithmetic—XX., Art. 7, since $3 + 5 + 8 = 16$, we divide 400 into 16 equal parts, each of which is £25.

The respective shares of A, B, and C will be £75, £125, and £200.

2. If the sum invested by each partner is not used for the same period of time, so that we have to take into account not only each sum, but the time during which it is employed, the case is called one of *Double or Compound Fellowship*.

EXAMPLE.—A, B, and C contribute to a business as follows: A puts in £1,200 for three months, B £1,000 for six months, and C £800 for twelve months. How must they divide a profit of £800?

A's £1,200 for 3 months is the same as $3 \times £1,200$, or £3,600 for 1 month.

B's £1,000 for 6 months is the same as $6 \times £1,000$, or £6,000 for 1 month.

C's £800 for 12 months is the same as $12 \times £800$, or £9,600 for 1 month.

Hence the shares must be in the proportion of 3,600, 6,000, 9,600; i.e., of 3, 5, 8.

Hence, proceeding as in Simple Fellowship, the shares will be respectively

£280, £560, £800; that is, £150, £250, £400.

This example sufficiently explains the following

Rule for Compound Fellowship.

Multiply each capital by the number of units of time for which it is employed; the shares will be in the proportions of these products, and will be determined as in a case of Simple Fellowship.

EXERCISE 60.

1. A traveller divided 80s. among 4 beggars in such a manner that as often as the first received 10s., the second received 9s., the third 8s., and the fourth 7s. What did each receive?

2. A, B, and C engage in business, putting in respectively £3,500, £5,000, and £6,000. What would be the share of each out of a profit of £4,000?

3. A, B, and C contribute respectively to a speculation £160, £240, and £480, and they gain £264. What will be the share of each?

4. A, B, C, and D embark in a business, and put in respectively £2,000 for 6 months, £1,500 for 9 months, £1,000 for 12 months, and £500 for 15 months. If at the end of 15 months the profits are found to be £1,000, how must they be divided?

5. A and B form a partnership for a year. A contributes £5,000, to which at the end of 6 months he adds £1,000 more; B contributes £6,000, and at the end of 9 months withdraws £2,000 from the business. How must they divide a profit of £1,500 at the end of the year?

6. A, B, and C form a partnership; A contributing £1,000, B £2,000, and C £3,000. After 9 months C withdraws, and after 3 months more D is admitted to the partnership, contributing £1,500. At the end of 18 months, the partnership being dissolved, the profits are found to be £900. How must they be equitably divided?

KEY TO EXERCISES IN ARITHMETIC.—XXXVIII.

EXERCISE 58.

- | | | |
|------------------------------|---------------------------|--------------------------|
| 1. (1) $3\frac{1}{2}$ years. | (2) $3\frac{1}{2}$ years. | 3. $69\frac{1}{2}$ days. |
| 2. (1) $11\frac{1}{2}$ m. | (2) $11\frac{1}{2}$ m. | 4. 5 years. |

EXERCISE 59.

- | | | |
|---------------------------------------|--|------------------|
| 1. $3\frac{1}{2}$. | 8. £87. | 15. 103. |
| 2. $3\frac{1}{2}$. | 9. £33 6s. 8d. | 16. The first. |
| 3. $4\frac{1}{2}$. | 10. £6,917 18s. 4d. | 17. £52 10s. |
| 4. In the Three per Cents. | 11. £13 10s. 10d. | 18. £51,830 10s. |
| 5. $4\frac{1}{2}$; $4\frac{1}{2}$. | 12. £19 10s. 8d. less; | 19. £818 8s. |
| 6. In the Three and a Half per Cents. | 13. 60 and £33 6s. 8d. | 20. £77 2s. 4d. |
| 7. 100%. | 14. $91\frac{1}{2}$; or 91-25 nearly. | 21. £475. |

G R E A T B O O K S .

XIII.—THOMSON'S "SEASONS."

It is customary to speak of Thomson as a Scotch poet; but it would be difficult to give a more inexact description of him. The poet of "The Seasons" was born in the neighbourhood of Kelso, in Roxburghshire, a few miles beyond the English border. His mother was the daughter of a Mr. Trotter, of Foggo, in Berwickshire; so that he appears to have belonged entirely to that south-eastern part of Scotland which is English in population, and at one time formed a portion of the kingdom of Northumberland. Thomson wrote all his poems in pure, classical English—either the scholarly English of Milton, as in "The Seasons" and most of his other works, or the somewhat archaic English of Spenser, as in "The Castle of Indolence." His mind does not seem to have had any Scottish leanings, such as were powerfully developed in Allan Ramsay (a contemporary of Thomson), Burns, Sir Walter Scott, and several others. His patriotism, as evinced in such poems as "Britannia" and "Liberty," was distinctly British and Imperial, without any reference to the particular quarter of the realm within which he had himself been born; and it may be doubted whether Thomson would not have regarded "an auld Scots song," or a new one either, as anything better than a piece of provincial barbarism. He came to London at twenty-five years of age, and it does not appear that he ever returned to Scotland. Thomson must therefore be reckoned among the English poets, even though "Scotia," in the language of Burns, may, "with exulting tear," proclaim that he was her son.

When the young genius arrived at London, in 1725, he brought with him some fragments of the poem on "Winter," afterwards forming part of "The Seasons." He was advised to combine these into one connected piece, and to get it printed forthwith. On the poem being completed, it encountered the usual difficulties which beset the productions of unknown authors. For awhile, it could find no publisher; but at length it was sold at a low price, and issued in 1726, with commendatory verses by Hill, Mallet, and a lady who wrote under the fictitious name of "Mira." In the first instance, it fell still-born from the press; but, chancing to please an influential gentleman of taste in those days, named Whateley, he literally brought it into fashion by praising it wherever he went. Repeated editions were called for, and Thomson suddenly found himself the happiest and proudest of men, a successful poet. That was the age of patrons; for, although there was a book-buying public, it was not considered safe to rely on the general body of readers without the protection of some great man, whose favour was usually procured by a fulsome dedication. Thomson inscribed his "Winter" to Sir Spencer Compton, who, however, took no notice of the author until his friend Hill published in a newspaper some verses to Thomson, in which he rebuked the great for their neglect of genius. The conscience-stricken Sir Spencer immediately sent the poet twenty guineas.

The poem on "Summer" followed in 1727; "Spring" was published in 1728, and "Autumn" in 1730. The four divisions make up the work which we know as "The Seasons," but which in fact arose in the fragmentary way we have just related. If we had had regard simply to intrinsic qualities, we should not have included Thomson's "Seasons" in our list of "Great Books." Pleasing and attractive as the poem is in many respects, it is not great in any true sense of the word. A poem which consists almost entirely of description, which contains neither story nor exposition of character, which is concerned in none of the grand passions of human nature, and which results from the power to observe, rather than from the power to

imagine, cannot properly be included among the highest productions of genius. Yet this particular work has so distinctive a place in the poetic literature of England, and is so associated in the general mind with the achievements of the national intellect, that it was difficult to omit it. Perhaps the best of Thomson's poems is "The Castle of Indolence," where the imitation of Spenser's manner sometimes passes beyond mere imitation, and reproduces, if only by reflection, the rich and many-coloured splendour of "The Faery Queen." But the most popular work of Thomson is undoubtedly that which describes the appearances of Nature at the four leading periods of the year.

The style, in itself, is not of the best. It abounds too much in that species of phraseology which our ancestors termed "poetic diction," and which Wordsworth, in his reforming zeal, denounced as thrusting out of view the simple truth of things. For the original of that style, we must look to a very great man indeed. The blank verse of Thomson, and the general character of his construction in these poems, is Miltonic, but Miltonic by an aggravation of whatever was most academic and self-conscious in the "Paradise Lost." That much of "The Seasons" is inflated, pedantic, and pretentious, with artificial inversions, cumbrous elaborations of expression, and a method of delivery which too often overlays the thought with the mere literary art of ceremonious presentation, is not to be denied; yet it is none the less true that the poetic feeling is frequently genuine and subtle. It is curious to observe how the poet will labour round and round an idea through a long array of lines, without doing much more than accumulating a heap of sonorous words; and then, by some happy instinct, will suddenly plunge down upon the precise image that was wanted to produce the desired effect. A passage in the poem on Spring will sufficiently illustrate this combination of weakness and strength:—

"Hence, in old dusky time, a deluge came,
When the deep-cleft, disparting orb, that arch'd
The central waters round, impetuous rush'd,
With universal burst, into the gulf,
And o'er the high-piled hills of fractured earth
Wide dash'd the waves in undulation vast;
Till, from the centre to the streaming clouds,
A shoreless ocean tumbled round the globe."

The prevailing character of this description is verbose; it is only in the last line that the poet really feels his subject. Thomson, however, was often very felicitous in his phraseology; for instance, in such expressions as "The ceaseless winds blow ice," or—

"The deep-fermenting tempest, brew'd
In the grim evening sky."

The poet is at his best when he writes from his own natural observation of the universe, and abstains from the superficial vein of moralising which he seems to have considered necessary. After all drawbacks have been made, many will ratify the criticism of Johnson, that "The reader wonders that he never saw before what Thomson shows him, and that he never yet felt what Thomson impresses."

LESSONS IN BOOKKEEPING.—XIX. FOREIGN TRADE.

HAVING allowed our students time to study the principles and practice of Bookkeeping as applicable to the transactions of *Home Trade*, we now proceed to lay before them a series of transactions in *Foreign Trade*, and afterwards to show them how to enter these transactions into the proper books, as we have done in our preceding lessons in reference to *Home Trade*. The following Memoranda of Transactions are to be entered in the same manner as before: 1st. All Receipts and Payments of *Cash* in the *Cash Book*. Here, however, the transactions with the *Bank* are to be entered along with the *Cash* transactions in business; but they are not recorded in the Memoranda, because they would take up a quantity of unnecessary space, and the student can easily judge for himself how much money must be drawn from the *Bank* each day for the Payments, or how much should be lodged in the *Bank* from the Receipts. For this purpose, of course, he will make the proper entries in the separate columns appointed for the *Bank* transactions as shown in the *Cash Book* under the head of *Home Trade*. This process

renders it unnecessary for the merchant to keep a separate *Bank account* or *Bank Book*; and it shows by the balances at the end of the month, or of any other period when they are taken, how the *Bank* and *Business Cash* transactions operate as a check on each other, the difference between these balances being always the amount of *cash in hand*.

2nd. All Drafts and Remittances of Bills are entered in the *Bills Receivable Book*, and all Acceptances of Bills in the *Bills Payable Book*. In these two books, the columns for the various particulars relating to the Bills are more numerous than those shown in the *Bill Books* under the head of *Home Trade*. The student will, of course, be directed by the titles of these columns to insert every particular in its proper place. 3rd. The particulars of all the other transactions relating to the *Foreign Trade* are entered in the *Day Book*; but many of these particulars are copied from other books usually kept in a merchant's counting-house; viz., the *Invoice Book*, the *Account Sales Book*, the *Account Current Book*, the *Insurance Book*, etc.

MEMORANDA OF TRANSACTIONS.

July 1st, 1881.

Inventory of the Assets and Liabilities of the House of White, Smith, and Company, Merchants, London, as per Balance Sheet of Ledger B.

ASSETS.

Cash in the Union Bank	£2350 0 0
Exchequer Bills	5310 0 0
Bills Receivable	7300 15 0
Three per Cents. Stock £8000 at 90 per Cent.	5400 0 0
Debentures	513 0 0
Ship Victoria, our $\frac{1}{2}$ share	3000 0 0
Adventure in Scotch Linen	2467 0 0
Richard O'Brien and Co., Dublin	3530 12 0
Peter Hutchinson and Co., Liverpool	1350 10 0
Thomas Brown and Co., Falmouth	970 0 10

£32391 17 10

LIABILITIES.

Bills Payable	£2350 10 0
Insurance, premiums due	1830 15 0
Nathan Herschell, Barbadoes	1370 5 0
John Henderson, Barbice	720 5 0
Samuel Morley, London	990 15 0
Schofield, Halse, and Co., Jamaica	1150 10 0
Fox, Tennant, and Co., Liverpool	330 15 0

£3753 15 0

4th.
Effectuated by Andrew Lloyd, an insurance on 7 hds. of Sugar, valued at £23 per hd., from Barbice to London, at 8 per cent., the amount of premium being
Policy duty

£5 5 0
£0 4 0
£5 15 6

4th.
Effectuated on account of Nathan Herschell, Barbadoes, the foregoing Insurance:
Premium and Policy on £175
Commission on do., at $\frac{1}{2}$ per cent.

£5 15 6
0 17 6
£6 13 0

6th.
Received of David Anderson for freight per ship Victoria

£175 3 0

8th.
Effectuated by Andrew Lloyd, an Insurance on 20 tierces of Coffee, valued at £35 per tierce, from Barbice to London, at 2½ per cent. premium
Policy

£17 10 0
1 16 9
£19 6 9

8th.
Effectuated on account of John Henderson, Barbice, the foregoing Insurance:
Premium and Policy on £700
Commission on do., at $\frac{1}{2}$ per cent.

£19 3 9
3 10 0
£22 13 9

12th.
Paid Bill No. 101, Robert Simpson

£1145 13 0

18th.
Received in Cash for Bill No. 551 on Richard Sykes

£1200 0 0

29th.
Took out of Cash for Petty Cash

£10 0 0

*

August 1st.
Purchased Goods of the following persons:
Of Samuel Morley, 9 bales tow Osnaburghs
„ Tuelon and Co., 3 cases of Hats

£236 5 0
32 2 0
£268 7 0

2nd.
Paid Fox, Tennant, and Co. the balance of their account

£320 15 0

3rd.
Purchased Goods of the following persons:
Of William Phillips, shoes, amounting to
„ James Parker, linen tick
„ Matheson and Co., platillas
„ Thomas Barker, lint Osnaburghs

£273 15 11
42 0 0
328 5 4
367 10 0
£1016 11 3

4th.
Received of Thomas Brown and Co., balance of account

£970 0 10

5th.
Effectuated by Andrew Lloyd, an Insurance on £1500 on Sundry Goods, from London to Jamaica, at 2 per cent. premium
Policy

£30 0 0
3 18 9
£33 18 9

7th.
Shipped on board the Dreadnought, for Jamaica, on account and risk of Schofield, Halse, and Co., as per Invoice Book, fol. 1:
Sundry goods, amounting to
Charges of shipping, etc.

£1284 18 3
51 8 0
66 15 0
£1396 11 3

Commission, 5 per cent., on goods and charges
Insurance on £1500, and policy
Commission on do. at $\frac{1}{2}$ per cent.

33 18 9
7 10 0
£1444 10 0

10th.
Bought of R. Hastie and Co., of Liverpool, 60 barrels of Herrings, at 20s. each, including Insurance and shipping charges

£60 0 0

12th.
Shipped at Liverpool, on board the Fury, for Barbadoes, on account and risk of Richard Sykes, planter there, as per Invoice Book, fol. 2: 60 barrels of Herrings, amounting to
Commission on do. at 5 per cent.

£60 0 0
3 0 0
£63 0 0

14th.
Bought of James Oswald and Co., London, 6 bales lint Osnaburghs, amounting to

£240 0 0

16th.
Bought of the following persons, viz.:
Of Tuelon and Co., 3 boxes of hats, amounting to
„ William Phillips, 6 trunks of shoes, do.
„ W. Silver and Co., 1 cask of nails, do.
„ Thomas Barker, 9 bales tow Osnaburghs, do.
„ W. Smith and Co., 6 trunks printed muslins

£33 10 0
256 15 6
87 10 0
250 16 6
675 12 0
£1301 4 0

19th.
Effectuated by Andrew Lloyd, an Insurance on £2550, on Plantation Stores, from London to Jamaica, at 2 per cent. premium
Policy

£51 0 0
6 10 0
£57 10 0

21st.
Shipped on board the Rainbow, for Jamaica, on account and risk of John Roberts, planter there, as per Invoice Book, fol. 2:
Plantation Stores amounting to
Scotch Linen, 4 cases, do.
Charges of Shipping, etc.

£1544 4 0
808 6 0
21 0 0
59 7 0
57 10 0
12 15 0
£2593 2 0

Commission, 2½ per cent., on goods and charges
Insurance on £2550, and policy
Commission on do., at $\frac{1}{2}$ per cent.

£2593 2 0

23rd.
Accepted a Bill drawn by R. Hastie and Co., of Liverpool, dated August 13, No. 140, payable to Williams and Co., London, due November 16th

£60 0 0

25th.
Accepted three Bills drawn by Nathan Herschell, of Barbadoes, dated July 1st, viz.:
No. 141, payable to Roberts and Co., due Nov. 4th
„ 142, do. Thomas Riley, „ 200 0 0
„ 143, do. H. Green and Co., „ Dec. 4th
600 0 0

29th.
Received Drawback on Sugar per the Britain

£115 8 0

30th.
Paid for freight, etc., of goods per the Dreadnought

£33 10 6

31st.
Paid duties and fees on goods, per the Rainbow

£2 12 6

31st.
Took out of Cash for Petty Cash

£12 10 0

September 1st.
Received payment of Peter Hutchinson and Co.'s draft at sight on G. Barclay

£152 10 0

2nd.
Paid for duties and fees on goods per the Dreadnought

£12 17 6

3rd.
Accepted three Bills drawn by John Henderson, Barbice, dated July 16th, viz.:
No. 144, payable to Barnett and Co., due Nov. 19th
„ 145, „ Davis and Co., „ 200 0 0
„ 146, „ T. Gurney, „ Dec. 19th
300 0 0

5th.
Paid for freight, etc., of goods per the Rainbow

£13 7 6

6th.
Received of Richard O'Brien and Co., of Dublin, the following Remittances in Bills, viz.:
No. 610, dated Aug. 1, on Keunard and Co., at 3 months
„ 611, „ 5, „ J. Harris, „ 2 „
„ 612, „ 7, „ W. Melville, „ 3 „

£1000 0 0
580 0 0
876 15 0

8th.
Discounted at the Banker's, Larchin and Co.'s Bill, due Nov. 8th
Paid for Discount on ditto, for 2 months

£730 10 0
6 1 9

9th.
Disposed of the remaining 8 cases of Scotch Linen to Dawson and Hancock, merchants, London, for

£1750 0 0

10th.
Accepted 3 Bills drawn by John Henderson, Barbice, dated August 1st:
No. 147, payable to J. Wilson, due at 3 months
„ 148, do. T. Carr, „
„ 149, do. S. Curtis, „

£200 0 0
200 0 0
200 0 0

12th.
Paid Samuel Morley his Bill of Parcels
Received discount at 5 per cent. on do.
Paid Tuelon and Co. their Bill of Parcels
Received discount at 2½ per cent. on do.

£236 5 0
11 16 3
32 2 0
0 16 0

15th.
Paid William Phillips his Bill of Parcels
Received discount at 5 per cent. on do.
Paid James Parker his Bill of Parcels
Received discount at 5 per cent. on do.

£278 15 11
13 19 0
42 0 0
2 2 0

Paid Matheson and Co. their Bill of Parcels
Received discount at 5 per cent. on do.
Paid Thomas Barker his Bill of Parcels
Received discount at 5 per cent. on do.

323 5 4
16 8 3
367 10 0
13 7 6

17th.
Paid Bill No. 129, R. Adamson

£905 0 0

20th.
Received payment of Richard O'Brien and Co.'s draft at sight on Coutts and Co.

£500 0 0

21st.
Received for £3000 of Three per Cents. stock, sold at 94½ per cent.

£2346 5 0

23rd.
Paid freight of Sugar per the Ballarat

£23 15 4

25th.
Paid duties and fees on sugar per the Ballarat

£107 8 7

27th.
Received for Exchequer Bills transferred

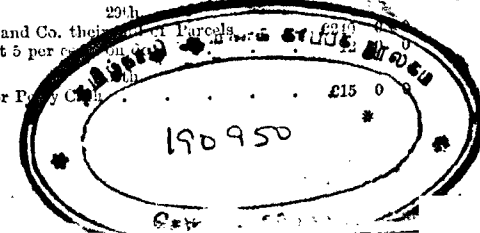
£1512 7 6

29th.
Paid James Oswald and Co. their Bill of Parcels
Received discount at 5 per cent. on do.

£15 0 0

Took out of Cash for Petty Cash

£15 0 0



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LESSONS IN ITALIAN.—III.

II.—PRONUNCIATION OF VOWELS AND CONSONANTS
(continued).

For further practice in the pronunciation of words in which vowels and mute consonants are combined, the reader's attention is directed to the following table as a continuation of the one given in the previous lesson.

It will be well, before commencing this exercise, to refer to the explanatory notes therein contained. I would especially desire my pupil readers to repeat aloud every word successively, until they have made themselves quite familiar with their various and distinct sounds.

Italian.	Pronounced.	English.
Veggo	veg-go	I see.
When the <i>g</i> 's are followed by <i>a</i> , <i>o</i> , or <i>u</i> , they are pronounced in each syllable like the English <i>g</i> in <i>get</i> .		
Oggi	ôd-jee	To-day.
Fuggi	flood-jee	Fly!
Pace	pâh-tchâi	Peace.
Pace	pâi-tchâi	Pitch.
Pino	pêe-no	Pine.
Poco	pôe-ko	Little.
Pute	pôe-tai	It has a bad smell.
Riparo	ree-pâh-ro	I repair.
Impéro	im-pêr-ee-o	Empire.
Tapino	tah-pêe-no	Wretched.
Sapone	sah-pôe-nai	Soap.
Impune	im-pôe-nai	Unpunished.
Pappa	pâhp-pah	Pap for children.
Peppo	pép-pai	Joseph, Joe.
Pippo	pep-po	Philip, Phil.
Coppa	kôp-pah	The occiput, gobbet.
Zuppa	tzôop-pah	Soup.
Tube	tâh-bai	Consumption.
Teco	tâi-ko	With thee.
Tipo	têe-po	Typo (a model).
Topo	tô-po	Mouse.
Tubo	tôo-bo	Tube.
Altare	ahl-tâh-rah	Altar.
Altéro	ahl-tê-ro	Haughty.
Altire	ahl-têe-rah	To mount.
Alloro	ahl-lô-ro	Laurel.
Altura	ahl-tôo-rah	Height.
Atto	âht-to	Act, action.
Getto	jêht-to	Cast, throw.
Fitto	fît-to	Rent.
Cotto	kôt-to	Cooked.
Tutto	tôot-to	All, quite.
Vano	vâh-no	Vain.
Vero	vâi-ro	True.
Vino	vêe-no	Wine.
Voto	vô-to	Vow.
Avuto	ah-vô-to	Had.
Bavaro	bâh-vah-ro	Bavarian.
Severo	sai-vê-ro	Severe.
Divino	dee-vêe-no	Divine.
Lavoro	lah-vô-ro	Labour.
Dovuto	do-vô-to	Debt, duty.
Davvi	dâhv-vee	He gives you.
Evvvi	êv-vee	Is there.
Udivvi	oo-div-vee	He heard you.
Davvi	dâv-vee	I give you.
Favvi	fâov-vee	Was there.
Zara	tzâh-rah	Zara, a town.
Zero	dzê-ro	Cipher.
Zitella	tzêe-tel-lah	Girl.
Zona	dzô-nah	Zone, girdle.
Zvgo	tzôo-go	Omelet.
Mazara	mah-tzâh-rah	Mazzara in Sicily.

In this and a few other cases, I am compelled for the sake of completeness of system, to make a slight departure from strict orthography. This word being properly written *Mazzara*, with two *z*'s, as well as the following words—*gazzera*, *azzimo*, *bazzotto*, *azzuffa*.

Gazera	gâh-dzâi-rah	A jay.
Azimo	âh-dzêe-mo	Unleavened.
Bazotto	bâh-dzô-to	Half-cooked.
Azzuffa	ah-tzâ-fah	He comes to blows.
Pazzo	pâh-tzo	Fool.

There is very little difference between the pronunciation of the single *z* and *zz*. The *zz*, as well as *z*, may have the sound

of *tz* in the word *switzer*, or *dz* in the word *adze*. According to modern orthography, the *z* is generally doubled between two single vowels in the middle of a word, but not after a consonant and not before diphthongs the first vowel of which is *i*; as, for examples, *ia*, *ie*, *io*, where it must remain single, and has the hard sound.

Pizzo	pêe-tzo	Piece.
Pizzo	pêe-tzo	Monstache.
Pizzo	pêe-tzo	A well.
Pazzo	pâo-tzo	A bad smell.
Pagato	pah-gâh-to	Paid.
Ithaca	êe-tah-kah	Ithaca in Greece.
Agape	âh-gah-pai	Agape, or Christian love-feast.
Ricamo	ree-kâh-mo	Embroidery.
Vegeto	vê-jit-to	Stout, robust.
Aceto	ah-tchâi-to	Vinegar.
Giuta	gah-âi-tah	Town in Naples.
Calice	tchâi-dâi-tai	Yield!
Calice	kâh-dee-tchâi	Cauliz.
Egida	ni-jêe-lah	Ægis.
Tacito	tâh-tchêe-to	Tacitus.
Vagito	vah-jêe-to	An infant's cry.
Rigoro	ree-gô-rah	Rigour.
Epoca	ê-po-ka	Epoch.
Pagoda	pâh-gô-dai	Pagoda.
Jacopo	jâh-ko-po	Jacob.
Aguto	ah-gôo-to	Nail.
Acuto	ah-kôo-to	Acute, ingenious.
Cicuta	tchêe-kôo-tah	Water hemlock.
Coato	tchâi-dôo-to	Yielded.
Apogeo	ah-po-jê-o	Apogee.
Capacitato	kah-pah-tchêe-tâh-to	Capacitated.
Educatore	ai-dôo-kâh-to	Educated.
Vocativo	vo-kah-têe-vo	Vocative.
Zebecoo	tzai-bai-dô-o	Zebecoo.
Tucidide	tôo-tchêe-dee-dai	Thucydides.
Abituato	ah-bee-tôo-âh-to	Habituated.
Zodiaco	dzô-dêe-ah-ko	Zodiac.
Agarico	ah-gâh-ree-ko	Fungus growing on larches.
Idiota	ee-dôe-ô-tah	An idiot.
Abigato	ah-bee-jai-âh-to	Stealing of cattle.
Vegetativo	vai-jai-tah-têe-vo	Growing.
Decapitato	dai-kah-pee-tâh-to	Decapitated.
Decaduto	dai-kah-dôo-to	Decayed.
Agitato	ah-jêe-tâh-to	Agitated.
Epiceuro	ai-pee-kôo-ro	Epiceurus.
Pedagogia	pai-dah-go-jêe-ah	Education and government of children.

III.—THE SEMI-VOWELS.

There are six semi-vowels in the Italian language, so called because in their utterance a vowel must be placed before the consonant. They are not pronounced in one syllable only, as in the case of the mutes, but require the utterance of two syllables, which syllables are substantially the same, though in an inverse order. The semi-vowels are—

1. *Ff*, named in the alphabet *effe* (pronounced in the following manner—êf-fai).

2. *Ll*, named in the alphabet *elle* (pronounced êl-lai). It has two sounds—one like the English consonant *l*; the second is a peculiar sound, of which I shall have occasion to speak in the pronouncing tables.

3. *Mm*, named in the alphabet *emme* (pronounced êm-mâi). To ensure perfect accuracy in the pronunciation, I may remark that when *m* is preceded by a vowel with which it forms one syllable, and a consonant being the next, it must be very softly sounded, and the voice must glide quickly to the next consonant, almost as if it formed part of the same syllable: for example, *ambizione*, ahn-bee-tzêe-ô-nai, ambition; *empio*, êm-pêe-o, impious; *ombra*, ôm-brâh, a shadow.

4. *Nn*, named in the alphabet *enne* (pronounced ên-nai). Generally speaking, this letter is pronounced just as in English; but the observation made on the *m* is equally applicable to *n*. In similar circumstances, the voice must glide quickly from the *n* to the succeeding consonant: for example, *andare*, ahn-dâh-rah, to go; *entrare*, ên-trâh-rah, to enter; *onda*, ôn-dah, a wave.

After *g*, *n* has a peculiar sound, which I shall have occasion to explain in the pronouncing tables. Often *n* is pronounced like *m* before words commencing with the consonants *b*, *m*, and *p*; as, *gran bestia*, pronounced grahm bê-stêeah, a boorish, insolent

fellow, great blockhead, etc.; *sculptore in marmo*, pronounced skol-pêe-rah im mahrr-mo, to chisel in marble; *con poca fatica*, pronounced kom pô-kah fah-têe-kah, with little fatigue. This is certainly the best pronunciation, because it is the genius of the Italian language, as in the classical tongues, particularly Greek, to soften the transition, or passing over, from one word to another, and often from one syllable to the other, by changes of consonants.

5. *Rr*, named in the alphabet *erre* (pronounced êr-rah). *R*, when it is followed by a consonant, must be vibrated with a stronger emphasis than in English; and it is on the other hand very soft before a vowel; as, *carla*, pronounced kahrr-ta, paper, and soft in *cara*, pronounced kâh-rah, dear.

6. *Ss*, named in the alphabet *esse* (pronounced ês-sai). This consonant has considerable variations, and is one of the most difficult to pronounce throughout correctly, for even in Italy there are variations.

A strictly correct and irreproachable pronunciation of this consonant can only be acquired by closely marking its utterance in all its shades by Italians who speak purely. Speaking generally, there are two leading sounds. One is a sharp, hissing sound, as in the English words *sing*, *sieve*; the other is a much milder sound, as in the English words *chess*, *ease*, *please*, etc. The following general rules will be sufficient for the guidance of the learner at present: the different exceptions to them will be stated more fully hereafter:—

First, the sharp sound of this consonant may be said to be the ruling sound, because it is heard in the greater number of syllables and words. I shall invariably mark it by the single letter *s*; and wherever this is used, the reader will remember that it represents the sharp, hissing sound of the letter, thus avoiding multiplicity of signs, which would be caused by using *ss*. It has always the sharp, hissing sound in the beginning of a word before a vowel; as, for example, *sale*, pronounced sâh-lai, salt; *sole*, sô-lai, the sun; *senpre*, sêm-prai, always; *subito*, sôo-bee-to, suddenly. It has also the sharp, hissing sound before the consonants *c*, *f*, *p*, *g*, and *t*; as, for example, in *scaltro*, skâhl-tro, shrewd; *sforzo*, sfôr-tzo, compulsion; *crespo*, krîi-spo, crisp; *pasqua*, pâh-skwah, Easter; *pasto*, pâh-sto, a meal. It has also the sharp and hissing sound after the consonants *l*, *n*, and *r*, and I may say a pre-eminently hard and hissing sound in this case; as, for example, *falso*, fâh-so, false; *corso*, kôrr-so, course; *arso*, âhrr-so, burnt; *forse*, fôr-sai, perhaps; *pianse*, peahh'-sai, he wept; *vinsè*, vin-sai, he vanquished. In Rome, the sharpness of the *s* after *l*, *n*, and *r* is generally so very audible, that it almost amounts to the utterance of a *ts*, as if the examples just given were written with the hard *z* pronounced with the English sound in the word *Switzer*; which, however, with all respect for the Eternal City and the "*bocca Romana*," I must pronounce to be a provincialism.

Secondly, the milder sound of the *s* occurs generally when it is placed between two vowels. As the nearest possible approach to it, I shall follow the practice of Mr. Walker in his English pronouncing dictionary, and mark it with a *z*: for example, *avviso*, ahv-vêo-zo, opinion; *guisa*, gwêe-za, guise, manner; *tesoro*, tai-zô-ro, treasure; *usura*, oo-zô-rah, usury; *sposa*, spô-za, bride; *accusa*, ahk-kôo-zah, accusation; *misericordia*, mee-zô-reeah, misery; *misura*, mee-zôo-rah, measure; and many other words, which might be cited as examples.

This rule is subject to several exceptions, the most important of which I must state here.

Many Italian adjectives end in *oso* and *osa*, and whenever before these terminations there is a vowel, the terminational *s* has the sharp, hissing sound; as, for example, *glorioso*, pronounced glo-ree-ô-so, glorious; *virtuoso*, virr-tôo-ô-so, virtuous; *tortuoso*, torr-tôo-ô-so, tortuous.

There are many compound words in Italian having the particles *dis* and *mis*, and before consonants the final *s* of these particles must have the sharp, hissing sound; as, for example, *disposizione*, pronounced dis-po-zee-tsee-ô-nai, disposition; *dismisura*, dis-mee-zôo-rah, excess (the reader will note in the two foregoing words, that the *s* of the particle *dis* has the hissing sound, while the next *s*, placed between two vowels, follows the general rule, and has the mild sound); *dispiacenza*, dis-peeah-tchên-tzah, displeasure; *discredita*, dis-krai-dee-fâh-rah, to discredit.

In the greatest part of compound words, where *s* begins the syllable, it has the sharp, hissing sound; as, for example, *proseguire*, pro-sai-gwêe-rah, continue; *risolvere*, ree-sôl-vai-rah, to dissolve; *presumere*, prâi-sôo-mai-rah, to presume; *risorgere*, ree-sôrr-jai-rah, to rise again; *trasustanziale*, trah-sôo-stahn-tsee-ô-to, transubstantiated.

There are other exceptions which I shall take occasion to point out as examples occur.

Further, *s* has the mild sound when it immediately precedes the consonants *b*, *d*, *g*, *l*, *m*, *n*, *r*, *v*; as, for example, *sharra*, pronounced zbâhrr-rah, bar, barrier; *disdire*, dis-dee-rah, to retract; *squardo*, zgwâhrr-do, look; *slentare*, zlon-tah-nâh-rah, to remove; *mania*, zmâh-neeah, madness; *snervare*, znerr-vâh-rah, to unnerve; *stradicare*, zrah-dee-kâh-rah, to eradicate; *svolto*, zvêl-to, lively, clever, nimble, easy. I have stated that the particles *dis* and *mis* before consonants have the sharp, hissing sound. There is no deviation from this rule, and these particles retain the sharp, hissing sound even before the last-mentioned consonants: for example, *disbandire*, pronounced dis-bahn-dêe-rah, to banish; *disdire*, dis-dee-rah, to retract; *disgombrare*, dis-gom-brâh-rah, to empty; *disleale*, dis-laiâh-lai, disloyal; *dismettere*, dis-mêt-tai-rah, to dislocate an arm, to dismiss (an affair); *disnervare*, dis-nerr-vâh-rah, to unnerve; *disradicare*, dis-rah-dee-kâh-rah, to eradicate; *disvenire*, dis-vai-nêe-rah, to swoon; *misgradito*, mis-grah-dêe-to, disagreeable; *misleale*, mis-laiâh-lai, disloyal; *misvenire*, mis-vai-nêe-rah, to swoon.

When *ss* is between two vowels, it does not follow the rule of the single *s*, but must be sounded with a sharp, hissing sound; as, for example, *fosso*, pronounced fô-so, a ditch, a canal; *rosso*, rôs-so, red; *posso*, pôs-so, I can.

LESSONS IN MUSIC.—XV.

PROCESS TO BE ADOPTED IN STUDYING THE EXERCISES
IN THESE LESSONS.

WHILE our pupils are continuing the study of *FATH* and *LAM* in connection with the following exercises, we shall touch on a few incidental topics of information that our pupils should carefully note for their guidance in studying and practising our exercises.

1. It will contribute to the confidence of our pupils, and to their hopes of some day singing at sight, to remember that every tune, with the exception of "minor" tunes to be mentioned hereafter, and some few others, begins on *DOH*, *ME*, or *SON*; so that having taken the key-note from your tuning-fork, and struck the chord, you are sure to be in possession of the right note to begin with. You will also find that the accompanying "parts" of a tune (adapted to lower voices) commence always on some note of this "common chord."

2. For the sake of the thorough workers, those who are so diligently following the course in which we are guiding them, it will be well to remind our pupils of the process through which they must pass in connection with each exercise, and of the reasons for each step of that process. Every exercise should first be—

a. LEARNED BY PATTERN from the MODULATOR. This will cultivate the ear and voice generally. It will teach the particular tune along with a pictorial representation of its intervals, and will accustom the mind more and more to that beautiful language of interval, which, by giving a distinct and uniform syllabic name to each interval of the scale, enables us, by the ever renewed association of the syllable with the sound, to sing with increasing ease and confidence. The "second part" should be learnt in the same manner—as though it were a separate exercise—before it is sung with the "air." The exercise should next be—

b. SOL-FARRED from the book. This will give scope for a more accurate observance of measure, as indicated by the accent marks, and allow the "parts" of a tune to be sung together. It also strengthens the association between the syllables and their proper intervals. But lest the syllables of a tune should come to be sung by mere "rote"—the pupil having no mental picture of their relative position on the modulator—it will be found advisable to require each exercise to be—

c. POINTED ON THE MODULATOR from memory. This will complete the knowledge of the tune, and greatly increase its teaching power. Every pupil should do this in his private

practice, and should be ready to do it at the teacher's call, before the class. But the sol-fa syllables, though invaluable as the mnemonics and interpreters of interval, and likely to be always useful in learning new tunes, and in studying the difficulties or beauties of particular passages, are only instruments for accomplishing the higher purposes of music. The learner must acquire the power of perceiving the musical "property" of a note, and of producing it, in connection with any syllable. With this view, the pupil should not shrink from the mental effort of pointing each exercise. This will make the perception of the characters and intervals of notes more perfectly mental, and independent of syllabic associations. It will also introduce the use of *sturs*—each utterance corresponding with a syllable of the verse, and not, as before, with every note of the music. But the highest attainment is reached when, the tune itself being perfectly mastered, it is—

d. SUNG TO SUITABLE WORDS. This exercise should not commence until the words themselves are thoroughly under-

stood, enjoyed, and loved; and then it should be performed with careful regard to *EXPRESSION*. Thus the pupil is introduced to a new study, most elevating and ennobling to the mind, which he will pursue in sympathetic converse with his teacher.

It is not necessary that the pupil should thus make the fullest use of one exercise before he passes to the next. It would be better that, at every season of practice, each of the above employments should have place—some new exercise being taught by pattern, a previous one sol-faed from books and pointed on the modulator, and an earlier one still "numbered" and sung to words. The pupil should keep a record of progress, both on the book and separately, showing to what extent each exercise has been used. On the book each exercise would be marked with the letters above used in connection with each employment—a indicating that the exercise had only been learnt by pattern—*a, b*, that it had also been sol-faed from the book, etc. A separate entry might be made in this wise: "May 6, Ex. 20, *a*; 19, *b, c*; 18, *d*; 13, 14, 15, *d*."

EXERCISE 25.—OLD ENGLAND'S HEART. KEY G. M. 112.

The Words from "Ballads for the Times," by Martin Farquhar Tupper. Tune, OLD ENGLISH.

2. Old England's heart with beating nerves,
It rallies for the throne;
And yet, like Luther, well preserves
THE KNEE FOR GOD ALONE.
Old England's heart is sound enough,
Unshaken and serene;
'Tis like her oak-trees, true and tough,
And old—BUT GLAD AND GREEN.

3. Our England's heart! Ay, God be praised,
That thus, in patriot pride,
AN ENGLISH CHEER can yet be raised
Above the stormy tide.
'TIS SAFE ENOUGH AND SOUND ENOUGH,
IT THRILLS THE HEART TO FEEL,
A MAN'S A BIT OF ENGLISH STUFF,
AND TRUE FROM HEAD TO HEEL.

When you come to sing this tune to words, be careful to observe the *LOUD* and *soft* phrases, as indicated by the capitals and italics. But a better way still is to throw your own soul into the sentiment of the words of the song, forgetting yourself and your hearers in the thoughts and feelings you utter, and sing accordingly.

EXERCISE 26.—CROSSCOMBE. KEY C. M. 80.

The Words from "Ballads for the Times," by Martin Farquhar Tupper. Tune, OLD ENGLISH.

2. Many a foe is a friend in disguise,
Many a sorrow a blessing most true,
Helping the heart to be happy and wise,
Bringing true love and joys ever new.

Stand in the van, strive like a man,
This is the bravest and cleverest plan—
TRUSTING IN GOD WHILE YOU DO WHAT YOU CAN:
CHEERILY, CHEERILY, THEN CHEER UP!

These two songs will show *LAH* and *FAH* in new positions, and with new rhythmical arrangements. The pupil will pay special attention to these two notes wherever he finds them. The "time" in this tune will be rather difficult, but must be kept perfectly. Remember that, with proper care and self-discipline at first, it is easier to be perfect than imperfect.

READINGS IN FRENCH.—III.

LE SAPEUR DE DIX ANS.

SECTION VII.

Le général qui commandait, voyant (a) que le salut d'une partie de l'armée dépendait de la destruction de ce pont,¹ voulut envoyer quelques sapeurs pour abattre cette poutre et entraîner (b) le reste de la charpente;² mais au moment où ils s'apprêtaient à s'embarquer, l'ennemi arrive de l'autre côté de la rivière,³ et commence un feu si terrible de coups de fusil, qu'il ne paraissait (c) pas probable qu'aucun sapeur pût (d) arriver vivant jusqu'à la fatale poutre.⁴ Aussi allait-on se retirer en se défendant,⁵ lorsque tout à coup on voit s'élever un soldat dans la rivière,⁶ une hache sur l'épaule; il plonge et repart bientôt,⁷ et à (e) sa grande barbe⁸ on reconnaît que c'est un sapeur qui se dévoue au salut de tous. Tout le régiment attentif le suit (f) des yeux⁹ tandis qu'il nage et que les ennemis font (g) bouillir l'eau autour de lui d'une grêle de balles;¹⁰ mais le brave sapeur n'en (h) avance pas moins vigoureusement. Enfin il arrive après des efforts inouïs, monte sur le pied de la pile,¹¹ et, en quelques coups de hache, abat (i) le reste de la poutre qui de loin semblait énorme, mais qui était aux trois quarts brisée. Aussitôt la charpente des deux arches s'abîme dans la rivière,¹² l'eau jaillit en l'air avec un fracas terrible, et l'on ne voit plus le brave sapeur. Mais tout à coup, parmi les débris qui surmontent (j), on l'aperçoit se dirigeant (k) vers la rive.¹³ Tout le monde s'y élance rempli d'admiration et de joie;¹⁴ car malgré tant de malheurs, on était joyeux de voir faire de si nobles actions; on tend des perches au nageur, on l'excite, on l'encourage; le général lui-même s'approche jusqu'au bord de l'eau, et n'est pas peu étonné de voir sortir Bilboquet avec une grande barbe noire pendue au menton.¹⁵

"Qu'est-ce que cela?" s'écrie-t-il, "et que signifie cette mascarade?"¹⁶

"C'est moi," (l) dit le tambour, "c'est Bilboquet,¹⁷ à qui vous avez promis qu'on lui donnerait la croix, quand il aurait de la barbe au menton. En voici une qui est fameuse, j'espère.¹⁸

Allez, allez (m), je n'y ai rien (épargné; il y en a pour (n) votre argent, et vos vingt francs y ont passé."

Le général demeura stupéfait de tant de courage et de finesse à la fois.¹⁹ Il prit (o) la main à Bilboquet, comme s'il eût été un homme et lui donna sur-le-champ la croix que lui-même portait à sa boutonnière,²⁰ et qu'il avait gagnée aussi, à force de bravoure et de services. Depuis ce temps, les anciens du régiment salueaient Bilboquet avec amitié,²¹ et le tambour-maître ne lui donna plus de coups de canne.

E. MARCO DE SAINT-HILAIRE.

COLLOQUIAL EXERCISE.

1. La destruction du pont était-elle nécessaire?
2. Qu'est-ce que le général voulait faire?
3. Que se passa-t-il lorsque les sapeurs allaient s'embarquer?
4. Qu'est-ce qui ne paraissait pas probable?
5. Qu'allait-on faire alors?
6. Que vit-on tout à coup?
7. Que fit ce soldat?
8. À quoi le reconnut-on pour un sapeur?
9. Le régiment le regardait-il?
10. Que faisaient les ennemis pendant ce temps-là?
11. Arriva-t-il enfin au pont?
12. Que se passa-t-il aussitôt?
13. Que vit-on parmi les débris qui surmontaient?
14. Que s'empressa-t-on de faire alors?
15. Pourquoi le général fut-il surpris?
16. Que dit-il au petit tambour?
17. Que répondit Bilboquet?
18. Que dit-il en montrant sa barbe?
19. Quel sentiment le général éprouva-t-il?
20. Comment récompensa-t-on notre héros?
21. De quelle manière fut-il traité après, par les anciens du régiment?

NOTES.

- (a) From voir.
(b) Entrainer, throw down.
(c) From paraître.
(d) From pouvoir.
(e) A, by.
(f) From suivre.
(g) From faire.
(h) En, on that account.
(i) From abattre.
(j) Surmontant, float.
(k) Se dirigeant vers, swimming towards.
(l) C'est moi, it is I.
(m) Allez, allez, I assure you; literally, go, go.
(n) Il y en a pour votre argent, there is the worth of your money.
(o) From prendre.

LE CHÂTEAU DE CARTES.

Un bon mari, sa femme, et deux jolis enfants.¹

Coulaient (a) en paix leurs jours dans le simple ermitage.²

Où, paisibles, comme eux, récurrent (b) leurs parents. Ces époux, partageant (c) les doux soins du ménage, Cultivaient leur jardin, recueillaient (d) leurs moissons;³ Et le soir, dans l'été sous le feuillage,

Dans l'hiver devant leurs (e) tisons,⁴ Ils prêchaient à leurs fils la vertu, la sagesse;⁵ Leur parlaient du bonheur qu'ils (f) procuraient toujours.⁶ Le père par un conte égayait ses discours, La mère par une caresse.⁷

L'aîné de ces enfants, né (g) grave, studieux, Lisait (h) et méditait sans cesse;⁸ Le cadet, vif, léger, mais plein de gentillesse, Sautait, riait (i) toujours, ne se plaisait (j) qu'aux jeux.⁹

Un soir, selon l'usage, à côté de leur père, Assis près d'une table où s'appuyait la mère, L'aîné lisait Rollin;¹⁰ le cadet, peu soigneux (k) D'apprendre les hauts faits (l) des Romains ou des Parthes. Employait tout son art, toutes ses facultés,

À joindre, à soutenir par les quatre côtés Un fragile château de cartes.¹¹

Il n'en respirait pas (m) d'attention, de peur. Tout à coup voici le lecteur Qui s'interrompt (n); "Papa," dit-il, "daigne m'instruire Pourquoi certains guerriers sont nommés conquérants. Et d'autres fondateurs d'empire:

Ces deux noms sont-ils différents?"¹² Le père méditait une réponse sage,¹³ Lorsque son fils cadet, transporté de plaisir, Après tant de travail, d'avoir pu (o) parvenir À placer son second étage,¹⁴

S'écrie: "Il est fini!"¹⁵ Son frère murmurant, Se fâche (p) et d'un seul coup détruit (q) son long ouvrage;¹⁶ Et voilà le cadet pleurant.

"Mon fils," répond alors le père, "Le fondateur c'est votre frère, Et vous êtes le conquérant."¹⁷

FLORIAN.

COLLOQUIAL EXERCISES.

1. Combien de personnes y avait-il dans cette famille?
2. Quelle était leur habitation?
3. Quelles étaient les occupations de ces époux?
4. Où s'occupaient-ils dans l'été et dans l'hiver?
5. Que recommandaient-ils à leurs enfants?
6. De quoi leur parlaient-ils?
7. De quelle manière égayaient-ils leur conversation?
8. Quel était le caractère de l'aîné?
9. Le cadet ressemblait-il à l'aîné?
10. Que faisait l'aîné, un soir à côté de son père?
11. De quoi le cadet s'occupait-il alors?
12. Quelle question l'aîné fit-il à son père?
13. Le père lui répondit-il sur-le-champ?
14. De quoi le cadet était-il joyeux?
15. Que dit-il?
16. Que fit alors l'aîné?
17. Quelle fut enfin la réponse du père?

NOTES.

- (a) Coulaient, spent.
(b) From lire.
(c) From vivre.
(d) Partageant, from partager, sharing.
(e) From recueillir.
(f) Leurs tisons, their fire; literally, fire-brands.
(g) The ils is here a poetical licence; the pronoun should be elles, as it relates to vertu and sagesse, which are feminine.
(h) Né, by nature; literally, born; from naître.
(i) From lire.
(j) From vivre.
(k) So plaisait, delighted.
(l) Soigneux, desirous.
(m) Faits, deeds.
(n) Il n'en respirait pas, he hardly ventured to breathe.
(o) From interrompre.
(p) From pleurer.
(q) Se fâche, gets angry.
(r) From détruire.

KEY TO EXERCISES IN LESSONS IN FRENCH.

EXERCISE 94 (Vol. I, page 356).

1. Combien ma maison vaut-elle? (Combien vaut ma maison?) 2. Elle vaut une vingtaine de mille francs. 3. Ce cheval-là vaut-il autant que celui-ci? 4. Ce cheval-ci vaut deux cents dollars, et celui-là trois cents. 5. Cela vaut-il la peine d'écrire à M. votre frère? 6. Cela n'en vaut pas la peine. 7. Cela vaut-il la peine de sortir, quand on n'a pas envie de se promener? 8. Cela n'en vaut pas la peine. 9. Vous convient-il d'écrire demain à mon frère? 10. Il ne me convient pas de lui écrire. 11. Vous sied-il de me reprocher ma négligence? 12. Il me sied de vous blâmer, quand vous le mériteriez. 13. De combien cet homme est-il riche? 14. Je ne puis vous le dire au juste; (il est riche) d'une cinquantaine de mille francs. 15. Ce drap est-il bon? 16. Non,

Monsieur, il ne vaut rien. 17. Votre fusil vaut-il autant que le mien? 18. Oui, Monsieur, il vaut davantage. 19. Voulez-vous aller chez mon père? 20. Non, Monsieur, j'ai autre chose à faire. 21. Vaut-il mieux aller au marché de bonne heure que tard? 22. Il vaut mieux y aller de bonne heure. 23. Combien votre cheval peut-il valoir? 24. Il ne vaut pas beaucoup, il est très vieux. 25. Votre montre est-elle meilleure que la mienne? 26. Elle ne vaut pas grand-chose, elle ne va pas. 27. Ce livre vaut-il deux francs? 28. Il en vaut un, au plus. 29. Avez-vous demandé à votre sœur combien vaut ce livre? 30. Je ne le lui ai pas demandé. 31. Que me faut-il faire? 32. Il vous faut parler à M. votre père. 33. Lui faut-il de l'argent? 34. Il lui en faut. 35. N'a-t-il pas vendu son cheval? 36. Il l'a vendu, mais il ne valait pas beaucoup.

EXERCISE 95 (Vol. I, page 356).

1. What has been taken from you? 2. My books, my pencils, and my penknife have been taken from me. 3. Do you know who has taken them from you? 4. I do not know him who has taken them from me, but I know that he lives here. 5. Have you asked for your books? 6. I have asked my cousin for them. 7. Has he returned them to you? 8. He has paid me for them. 9. Has much fruit been stolen from you this year? 10. Vegetables have been stolen from me, but no fruit has been stolen from me. 11. Have you paid the peasant for your hat? 12. I have not paid him for it, I have paid the hatter for it. 13. Whom have you asked for information? 14. I have asked the traveller. 15. Do you know who has just knocked at the door? 16. It is Mr. L., who is asking for you. 17. For whom have you asked? 18. I asked for your brother. 19. Has your brother paid all his debts? 20. He has not paid them yet, because he has not received his income. 21. Have you paid him for what you bought of him? 22. I have paid him for it. 23. Have you not paid them your rent? 24. I have paid it to them. 25. They have paid us for our house.

EXERCISE 96 (Vol. I, page 356).

1. Avez-vous payé votre propriétaire? 2. Je lui ai payé mon loyer. 3. Lui avez-vous payé les fenêtres que vous avez cassées? 4. Je les lui ai payées. 5. Le chapelier a-t-il payé tous ses chapeaux? 6. Il ne les a pas payés, il les a achetés à crédit. 7. Payez-vous tous les jours ce que vous devez? 8. Je paye mon boucher toutes les semaines. 9. Lui avez-vous payé sa viande? 10. Je la lui ai payée. 11. Qui avez-vous demandé, ce matin? 12. J'ai demandé M. votre frère. 13. Pourquoi n'avez-vous pas demandé mon père? 14. Je sais que M. votre père est en Angleterre. 15. A-t-on payé ses chapeaux au chapelier? 16. On les lui a payés. 17. Vous a-t-on pris votre argent? 18. On m'a volé mon chapeau. 19. Avez-vous demandé votre argent à votre frère? 20. Je le lui ai demandé, mais il ne peut me le rendre. 21. N'a-t-il pas d'argent? 22. Il vient de payer toutes ses dettes, et il n'a pas d'argent de reste. 23. Avez-vous demandé de l'argent à M. votre père? 24. Je ne lui en ai pas demandé, je sais qu'il n'en a pas. 25. Chez quel libraire avez-vous acheté vos livres? 26. Je les ai achetés chez votre libraire. 27. Avez-vous tort de payer vos dettes? 28. J'ai raison de les payer. 29. Qui me demande? 30. Le médecin vous demande. 31. Qui frappe? 32. Votre cordonnier frappe.

EXERCISE 97 (Vol. I, page 370).

1. Did the banker receive much money last week? 2. He received much. 3. As soon as you perceived your brother, did you not speak to him? 4. As soon as I perceived him, I spoke to him. 5. Have you worn your new clothes already? 6. I have not yet worn them. 7. When he gave you money yesterday, did you thank him? 8. I thanked him, and begged him to thank you. 9. Have you found your books? 10. I have not found them yet. 11. When you came to see us, did you not finish your affairs with my father? 12. I finished them then, and paid him. 13. Have you not seen your eldest sister, during your stay in Lyons? 14. I have not seen her. 15. Did you not go to bed too soon last night? 16. I went to bed late. 17. At what hour did you rise this morning? 18. I rose at five o'clock; I generally rise early. 19. Did you not seek to escape from your prison last year? 20. I have never tried to escape. 21. Have you sold your property? 22. I have not sold it. 23. What have you given to the soldier? 24. I have given him nothing. 25. During his stay at B., we gave him all that he wished.

EXERCISE 98 (Vol. I, page 370).

1. Que reçûtes-vous la semaine dernière? 2. Nous reçûmes cinquante francs de votre ami, et vingt-cinq de votre frère. 3. Menâtes-vous votre fils à l'église hier? 4. Je ne l'y menai pas. 5. Que perdîtes-vous l'année dernière? 6. Nous perdîmes notre argent, nos habillements et nos chevaux. 7. Les avez-vous cherchés? 8. Je les ai cherchés, mais je ne les ai pas trouvés. 9. Parla-t-on de votre frère hier? 10. On parla de lui et de vous. 11. Qu'est-ce que le médecin vous a donné? (or) Que vous a donné le médecin? 12. Il ne m'a rien donné. 13. À quelle heure votre sœur se leva-t-elle hier? 14. Elle se leva à cinq heures. 15. Vous êtes-vous levés de bonne heure ce matin? 16. Nous nous sommes levés à six heures et demie. 17. Votre cousin a-t-il vendu toutes ses propriétés? 18. Il ne les a pas vendues, il les a données à sa sœur aînée. 19. Le voyageur vous a-t-il raconté ses aventures? 20. Il me les a racontées. 21. Cet homme a-t-il

cherché à parler à votre père? 22. Il a cherché à lui parler. 23. Le professeur a-t-il parlé de votre frère, pendant son séjour chez vous? 24. Il a parlé de lui. 25. Votre ami a-t-il porté son habit neuf? 26. Il ne l'a pas encore porté. 27. Avez-vous remercié votre frère? 28. Je l'ai remercié. 29. Qu'avez-vous donné à votre sœur aînée? 30. Je ne lui ai rien donné, je n'ai rien à lui donner. 31. Quand M. votre frère vous donna un livre, l'année dernière, le remerciâtes-vous? 32. Je ne le remerciai pas. 33. Est-il tard? 34. Il n'est pas tard, il n'est que six heures. 35. Fait-il beau temps, ou mauvais temps? 36. Il fait très beau temps.

EXERCISE 99 (Vol. I, page 371).

1. Did our scholars become weary of waiting so long yesterday? 2. They were obliged to wait so long that, at last, they lost patience. 3. Did you not receive your relation, kindly, when he came to see you? 4. I received him as well as I could. 5. Did you not read your brother's letter, this day before yesterday? 6. I read it, and sent it to my uncle. 7. Did you not run to the assistance of your brother, as soon as you saw him in danger? 8. I hastened to succor him. 9. Have you not hastened to come? 10. We have hastened. 11. As soon as you had perceived my brother, did you not inform me of his arrival? 12. I informed you of it. 13. At what hour did your sister come today? 14. She came at noon (twelve). 15. Did your companions come yesterday to beg you to accompany them? 16. They came to see me, but they left me without speaking to me of their journey. 17. Did you not paint a picture last year? 18. I painted an historical picture. 19. Has the Italian painter finished his portrait? 20. He finished it yesterday. 21. He has finished it this morning. 22. As soon as I had received this news, I sent for the notary. 23. Has that young man taken leave of his father? 24. He has taken leave of him. 25. He took leave of him yesterday.

EXERCISE 100 (Vol. I, page 371).

1. Le notaire vous accompagna-t-il hier? 2. Il m'accompagna jusques chez M. votre frère. 3. Votre compagnon prit-il congé de vous hier? 4. Il a pris congé de moi ce matin. 5. Lûtes-vous hier le livre que je vous ai prêté? 6. Je le lus avant-hier. 7. À quelle heure le peintre est-il venu ce matin? 8. Il est venu à neuf heures et demie. 9. A-t-il fini le portrait de M. votre père? 10. Il peignit hier toute la journée, mais le portrait n'est pas encore fini. 11. Ne courûtes-vous pas au secours de votre père, quand vous le vîtes en danger? 12. Je me hâtai de le secourir. 13. Que fîtes-vous quand vous arrivâtes? 14. Aussitôt que je fus arrivé, j'envoyai chercher mon frère. 15. Menâtes-vous votre sœur en Allemagne l'année dernière? 16. Je l'y ai menée cette année. 17. Menâtes-vous vos enfants à l'école hier? 18. Je les menai chez mon frère. 19. Peignîtes-vous un tableau d'histoire? 20. Je peignis un tableau d'histoire l'année dernière. 21. Mlle votre sœur vous a-t-elle prié de l'accompagner? 22. Elle m'a prié de l'accompagner. 23. Envoyâtes-vous chercher le notaire, aussitôt que vous reçûtes des nouvelles de M. votre père? 24. Je l'envoyai chercher. 25. Quand le notaire a-t-il pris congé de vous? 26. Il a pris congé de moi ce matin à neuf heures. 27. Le pharmacien (apothicaire) is rarely used now) a-t-il fini sa lettre? 28. Il ne l'a pas encore finie. 29. Ne fîtes-vous pas étonné hier de voir cette dame? 30. Je ne fus pas étonné de la voir. 31. Vous dépêchâtes-vous de lire votre livre hier au soir? 32. Je me dépêchai de le lire. 33. L'avez-vous fini? 34. Je ne l'ai pas encore fini.

EXERCISE 101 (Vol. I, page 372).

1. Of whom were you speaking this morning, when I came to you? 2. My cousin was speaking of her brother, and I was speaking of mine. 3. Did you not like beef better than mutton, formerly? 4. I used to like beef, but I never liked mutton. 5. Did you not (use to) sell many books when you lived in Paris? 6. I sold many, because I was a bookseller. 7. Has the bookseller sold many pencils this morning? 8. He has sold many pencils to-day. 9. Did you (use to) sell much parchment, when you were a bookseller? 10. I used to sell very little. 11. Did your brother (use to) wear a green coat when he lived in London? 12. He wore a brown coat and black slippers. 13. What were you seeking? 14. I was looking for my book. 15. How long had you lost it? 16. I had lost it since yesterday. 17. Have you found it again? 18. I had found it again, but I have lost it again (again). 19. Did that baker use to furnish you with good bread? 20. He used to furnish us with some excellent (bread). 21. Did you often punish your scholars? 22. I used to punish them, when they deserved it. 23. Where were you this morning, when I was looking for you? 24. I was in my room. 25. I was finishing my exercise.

EXERCISE 102 (Vol. I, page 372).

1. Qui était chez vous ce matin? 2. Mon ami G. y était, et il vous cherchait. 3. Avez-vous parlé à mon père hier? 4. Je lui parlai, quand on m'apporta votre lettre. 5. M. votre père portait-il un chapeau blanc, quand il demeura à Londres? 6. Il portait un chapeau noir, et mon frère portait un habit noir. 7. Chantiez-vous quand mon père est arrivé? 8. Non, Monsieur, je finissais mon thème. 9. Avez-vous perdu votre crayon, ce matin? 10. Je l'avais perdu, et je le cherchais quand vous m'avez parlé. 11. Vous aimiez la lecture; Mlle votre sœur l'aimait-elle aussi? 12. Elle l'aimait aussi.

13. Quelle chanson chantiez-vous ce matin? 14. Je chantais une chanson italienne. 15. Avez-vous eu peur de me parler? 16. Je n'ai jamais eu peur de vous parler. 17. Avez-vous apporté mon livre? 18. Je ne l'ai pas apporté.

EXERCISE 103 (Vol. I., page 394).

1. Why did you not write more quickly this morning? 2. Because I was afraid of making mistakes. 3. Were you not afraid of offending that lady? 4. I feared to offend her, but I could not do otherwise. 5. What were you painting this morning? 6. I was painting an historical picture. 7. What was your dyer dyeing? 8. He was dyeing cloth, silk, and linen. 9. What colour was he dyeing them? 10. He was dyeing the cloth black, and the silk and linen green. 11. Were you conducting the young Pole to school, when I met you? 12. I was conducting my eldest son to church. 13. What were you reading? 14. I was reading books which I had just bought. 15. Did you not know that that gentleman is dead? 16. I had forgotten it. 17. How much was the watch which you broke worth? 18. It was worth at least two hundred francs. 19. Was it not better to remain here than to go hunting? 20. It was much better to go to school. 21. What was your friend saying to you? 22. He was telling me that his brother is back from Spain. 23. Did you not (use to) go hunting every day when you were living in the country? 24. I often went fishing. 25. My brother went to school every day when he was here.

LESSONS IN CHEMISTRY.—XVIII.

CLASS I.—METALS OF THE ALKALIES.

POTASSIUM.

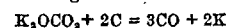
SYMBOL, K—ATOMIC WEIGHT, 39.1—SPECIFIC GRAVITY, 0.865—MELTING POINT, 62.5°.

SIR HUMPHRY DAVY, in 1807, included this metal in the list of brilliant discoveries which he made by means of the electrolytic action of the galvanic current. He slightly moistened some hydrate of potash, in order to render it a conductor, and then applied it to the poles of a strong battery. At the negative wire the metal potassium appeared.

The preparation of the metal may be conducted with much less expense by either of the following processes:—

1. Melted potassic hydrate is allowed to run over iron turnings in a bent gun-barrel, which is raised to a considerable temperature in a charcoal furnace. The iron deprives the potash of its oxygen, and the metal potassium passes over in vapour, which is condensed in naphtha.

2. The present mode of procuring the metal, however, was invented by Curandau. It consists in intimately mixing 69 parts of potassic carbonate and 12 parts of carbon. This mixture is heated in a crucible, and then the porous mass is broken into small pieces and introduced into an iron retort, which is submitted to a high heat.



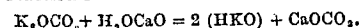
explains the action and intimates that the mixture is entirely converted into carbonic oxide and potassium. The delivery tube from the retort projects a few inches out of the furnace, and dips into a receiver of naphtha, which is kept cool by being surrounded by water.

Properties.—At ordinary temperatures potassium is a soft metal. When cut, it is found to be of a white colour. It has great affinity for oxygen, and will at a red-heat deprive almost any gas of that element. As we have seen, it can even decompose water, the heat evolved in the action being sufficient to set fire to the escaping hydrogen, the flame of which is tinged by the beautiful purple colour which is characteristic of the "potash flame."

Potash is the widely-diffused oxide of potassium. It takes its name from the fact that it is obtained from the "ashes" of the wood with which the "pot" has been boiled. Plants have the power of abstracting potash from the soil. It is a constituent of granite rocks, from which all soils are originally derived. The wood-ashes when washed have their potash dissolved by the water, and upon evaporating this solution "Pearl-ash" is obtained, which is really not potash, but an impure carbonate of potash, and forms one of the sources from which our potassium and its salts are derived.

Potassic Hydrate, or "Caustic Potash" (HKO).—If thin slices of potassium be exposed to dry oxygen, Potassium Monoxide (K_2O) is formed—a white, brittle substance. It absorbs moisture with avidity, forming potassic hydrate (HKO), in which it will be seen that one atom of K has been replaced by one of H.

The usual method of obtaining this compound is by boiling one part of potassium carbonate with twelve parts of water, and adding slaked lime made from two-third parts of quicklime. The reaction is—



The calcium carbonate (chalk) sinks to the bottom, while the clear liquid is decanted and evaporated without contact with the air. The residue may be cast into sticks, but the fusion should be carried on in silver vessels.

It deserves the name "caustic" from its severe action on animal tissues.

Potassium Carbonate (K_2CO_3).—This is imported from the forests of Russia and America in large quantities as *pot-ashes* or *pearl-ashes*.

To render it pure it is calcined like potassic hydrate. It is a strong alkali, and if exposed long enough to the air, absorbs moisture and becomes an oily liquid. By passing a current of carbonic dioxide through a solution of this salt, one of the atoms of K may be replaced by one of H, forming hydric potassium carbonate $\frac{H}{K}OCO_2$. This salt is not so soluble as the carbonate, and is almost neutral, having no effect on reddened litmus paper.

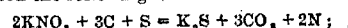
Potassium Nitrate, Nitre, or *Saltpetre* (KNO_3) is found as an efflorescence upon the soil in certain districts in the East Indies. The soil favourable to its production is of a loose limy nature, mixed with decomposing felspar, which contains potash, and of necessity there must be present more or less organic matter. The process by which the salt is produced is called "nitrication," and is little understood. It is supposed that the decomposing organic matter which contains nitrogen gives off ammonia; that this ammonia becomes oxidised into nitric acid, which with the potash forms nitre. In Sweden, the farmers have "nitre plantations," that is, they throw all the refuse of their farms, etc., into a heap, which they continually turn to expose it to the air. After three years, the bed is lixiviated, or washed with water. To this water pearl-ash is added, by which the nitrates of lime and magnesia are decomposed, and the nitrate of potash formed. Upon evaporation the nitre crystallises out, the insoluble carbonates having fallen.

Saltpetre contains nearly one-half its weight of oxygen, with which it readily parts when in contact with carbon. To this property it owes its commercial value, it being the chief ingredient of

Gunpowder, a compound which is said to have been discovered about 1336 by a certain Cordelier monk of Breslau, named Berthold Schwartz. This is unlikely, for the Arabians and Chinese had used an explosive substance for many centuries, and even Roger Bacon, who died about 1294, in his treatise "De Nullitate Magie," gives a receipt for making a kind of gunpowder. Our English powder consists of 75 parts of nitre, 15 of charcoal, and 10 of sulphur. The process of manufacture carried on at the Government mills at Waltham Abbey is the following:—

The ingredients are with great care procured perfectly pure. The charcoal is that of alder-wood; the proper proportion of each to make a "charge" of 52 lbs. is taken and ground separately into impalpable powder. The powders are then mixed, and water is added to make them into a paste; this is placed beneath two broad wheels fixed on the same axle, one of which rolls within the other, on a smooth iron plate. By this "incorporating mill" the ingredients are thoroughly mixed, and the paste is then submitted to a pressure of 70 tons on the square inch; the "press cake" thus produced rings, when struck, like a piece of metal. This cake is next broken by spiked rollers, and the grains sifted on sheets of parchment, perforated with different sized holes; these being placed one above the other, the large grains are delivered into their proper receptacle from the top sieve, the finest grains being found on the lowest. The powder in this condition is of a dull leaden colour, and is glazed by being placed in a barrel which revolves very rapidly on its axis; the grains polish each other by mutual friction; occasionally a little black-lead is added. This latter process renders the powder less liable to contract damp.

When ignited the following reaction occurs:—



that is, the solid becomes entirely gas, with the exception of the

K_2S (potassium sulphide), which is dissipated in smoke. These products of the combustion occupy, at the high temperature of the explosion, about 1,400 times the volume of the powder.

Pulvis fulminans is a mixture of 3 parts of nitre, 2 potassium carbonate, and 1 sulphur, which, when heated on an iron shovel until fusion takes place, explodes violently.

Of the other salts which potash makes with every acid Potassium Chlorate ($KClO_3$) is the most important. It is procured by submitting a mixture of potassium carbonate and slaked lime, moistened, to the action of chlorine gas; the chlorate formed is separated by lixiviation and crystallisation.

Potassium combines with the halogens and sulphur, when heated with them, forming many salts of great medicinal value.

All the salts of potassium, if introduced on a platinum wire into the reducing flame of the blowpipe, impart to the flame a purple tinge; and with bichloride of platinum, a concentrated solution containing potash gives a yellow precipitate.

SODIUM.

SYMBOL, Na—COMBINING WEIGHT, 23—SPECIFIC GRAVITY, 0.97—MELTING POINT, 98°.

The discovery of sodium was immediate upon that of potassium. The metal is obtained from sodium carbonate by an analogous method to that which produces potassium; it distils over with carbonic oxide, with which, unlike potassium, it does not combine.

Sodium is now prepared in large quantities, for it is used in the extraction of magnesium and aluminium from their salts. When thrown on water it decomposes it, but the action, unless the water be thickened by starch paste, is not sufficiently violent to ignite the escaping hydrogen.

Its compounds are widely distributed in Nature. Indeed, the "spectrum analysis" would indicate that the presence of sodium, in some form, is all but universal. The sea is its great repository, its waters containing 3 per cent. of sodium chloride, or common salt.

The Oxide of Sodium, or "caustic" soda (Na_2O), may be procured in a manner analogous to that which gave potash, and the same is the case with the hydrate—that is, by the action of milk of lime on carbonate of soda.

Sodium Nitrate ($NaNO_3$), or Chili Saltpetre, is found in that country in large quantities. Indeed, the natives of Chili and Peru build their houses of blocks of the salt. It cannot be used in the manufacture of gunpowder, for it is deliquescent; however, it is of indirect use, for nitre may be made from it.

Sodium Chloride ($NaCl$) may be procured from the sea by evaporation, but is generally supplied by salt mines, the principal of which are in Cheshire, Poland, and Spain. The Polish mine of Wieliczka is a mass of salt 500 miles in length, 20 in breadth, and at least 1,200 feet thick, a quantity sufficient to supply the culinary demands of the world for ages. Salt when crystallised is rock salt, or *sal gem*; the crystals are cubic.

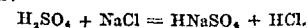
Sodium Sulphate ($Na_2SO_4 + 10 H_2O$), or Glauber Salt, is remarkably efflorescent; that is, it gives off its water and crumbles to powder. It has a saline bitter taste, and is used as a medicinal purgative.

Its preparation will be referred to in the making of **Sodium Carbonate** (Na_2CO_3), which constitutes the most important of chemical manufactures. It is used in the manufacture of glass and soap, in calico printing, in softening hard waters, and in the preparation of all the other salts of soda.

Formerly it was procured, as potash is still, from the ash of certain plants, but this has been superseded by its manufacture from the chloride.

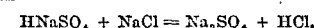
The process consists of two stages:—

1. **The Salt-cake Process.**—A charge of five or six cwt. of salt is thrown into a shallow cast-iron pan, about 9 feet in diameter, and 12 inches deep at the centre. The lid of this pan has two openings; through one an equal weight of sulphuric acid is introduced. The following reaction occurs when heat is applied:—



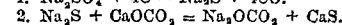
The hydrosodic sulphate remains, and the hydrochloric acid passes through the other opening to the bottom of a vertical flue, which is packed with pieces of coke, over which water is

allowed constantly to trickle; this water absorbs the gas, and is the source of the hydrochloric acid of commerce; when the action becomes sluggish, the hydrosodic sulphate is raked out and exposed to a higher heat in a chamber of brick-work, the flue from which also enters the vertical flue. By this means the atom of hydrogen which is associated with the sodic salt is driven off, thus—



This sodium sulphate which is the result of this process is known as *salt-cake*.

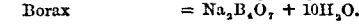
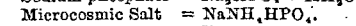
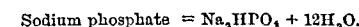
2. **Soda-ash Process.**—The salt-cake is ground up with an equal weight of chalk ($CaCO_3$) and half its weight of coal. The mixture is then submitted to the heat of a "reverberatory" furnace—that is, it is spread on a hearth, over which the flame of the furnace passes. The mixture melts, and these two reactions take place:—



The calcium sulphide and the other impurities being insoluble, the sodium carbonate, or *soda-ash*, is washed out. Soda crystals, used in washing, are got by saturating a solution with soda-ash, and allowing it to crystallise.

The Bicarbonate of Soda, which is used in effervescing drinks, is $\frac{Na}{H}OCO_2$, and is made by exposing soda crystals to the action of carbonic acid.

Sodium Hyposulphide ($Na_2OH \cdot OS_2O_3 + 4H_2O$) has the power of dissolving some silver salts; hence its employment in photography. Sodium is an element of these salts:—



The other sodium salts are of less importance.

LITHIUM.

SYMBOL, Li.—COMBINING WEIGHT, 7—SPECIFIC GRAVITY, 0.53—MELTING POINT, 180°.

Lithium is the lightest of the metals. The spectrum analysis declares it is widely distributed. By this means it has been detected in most waters, in milk, and in tobacco. Lithium chloride imparts to flame a brilliant crimson tinge. The metal itself is obtained by decomposing this salt by means of the galvanic current.

Lithia (Li_2O) stands between the alkalies and the alkaline earths.

AMMONIUM (NH_4) has been noticed.

RUBIDIUM and CÆSIUM owe their discovery to the spectrum analysis. Rubidium takes its name from the red line its compounds form in the spectrum. Cæsium gives two blue lines. These metals closely resemble potassium. Their salts are widely distributed, but in very small quantities. As yet they have no commercial and but little chemical interest.

LESSONS IN GREEK.—XVI.

COMPARISON OF ADJECTIVES.

SUPERLATIVE (from *super*, *above*, *beyond*, and *latus*, *carried*) is in grammar applied to adjectives when they are in that form which signifies the greatest degree or amount of the quality described by them. The degree below, or an inferior degree of the quality, is called the *comparative*; and the simple state of the adjective is named the *positive*: for example, *sweet* is the positive, *sweeter* the comparative, and *sweetest* the superlative.

The Greek language has two forms of comparison. The first, and by far the most common, adds to the positive $\text{-τερος, -τέρα, -τερον}$ for the comparative, and $\text{-τατος, -τατη, -τατον}$ for the superlative; the second adds for the comparative $\text{-ιον, -ιον, or -ων, -ων}$, and for the superlative $\text{-ιστος, -ιστη, -ιστον}$. The terminations -ος, -α, -ον , etc., respectively point out the masculine, the feminine, and the neuter gender.

As in Latin and English, the superlative in Greek denotes either the highest degree of a quality, or a very high degree.

Instead of these ordinary forms the comparative may be indicated by $\mu\alpha\lambda\lambda\omicron\nu$, *more*, and the superlative by $\mu\alpha\lambda\iota\sigma\tau\alpha$, *most*, put before the adjective.

Let us consider the forms of comparison of adjectives.

THE FIRST FORM OF COMPARISON.

	M.	F.	N.
Comparative	-τερος	-τερᾶ	-τερον.
Superlative	-τατος	-τατῇ	-τατον.

ADJECTIVES IN -ος, -η (-ᾶ), -ον.

Most of the adjectives of this class add the forms of comparison to the stem by means of the connecting vowel *o* or *ω*. The connecting vowel is *o* when a long syllable precedes; if a short syllable precedes, the connecting vowel is *ω*. A short syllable is a syllable the vowel of which is short; a long syllable is a syllable the vowel of which is long. Diphthongs are long, and a vowel followed by two consonants, or one double consonant, is long. A long vowel or a diphthong is said to be *long by nature*; a vowel made long by standing before two consonants, or one double consonant, is said to be *long by position*. The rule is exemplified in these words:—

Positive.	Comparative.	Superlative.
κοῦφ-ος, light;	κοῦφ-ο-τερος, lighter;	κοῦφ-ο-τατος, lightest.
ισχύρ-ος, strong;	ισχύρ-ο-τερος, stronger;	ισχύρ-ο-τατος, strongest.
λεπτ-ος, thin;	λεπτ-ο-τερος, thinner;	λεπτ-ο-τατος, thinnest.
σοφ-ος, wise;	σοφ-ω-τερος, wiser;	σοφ-ω-τατος, wisest.
εχθρ-ος, secure;	εχθρ-ω-τερος, securer;	εχθρ-ω-τατος, securest.

Contracted words in -εος, -οῦς, and -οος, -οῦς, undergo contractions also in the comparative and superlative; the former blend *e* and *o* into *ω*; the latter assume the connecting syllable *εσ*, and blend it with the foregoing *o*; thus—

πορφυρ-εος, purple;	πορφυρ-ους.
πορφυρ-εω-τερος,	πορφυρ-ω-τερος.
πορφυρ-εω-τατος,	πορφυρ-ω-τατος.
ἄπλος, simple;	ἁπλοῦς.
ἄπλο-εσ-τερος,	ἁπλο-ουσ-τερος.
ἄπλο-εσ-τατος,	ἁπλο-ουσ-τατος.

Here belong also contracted adjectives of two terminations in -ους and -ουιν, as *ευ-νοος*, *ευ-νοῦς* (*vell-disposed*), *ευ-νοον*, *ευ-νουιν*; comparative, *ευνο-εσ-τερος*, *ευ-νουσ-τερος*; superlative, *ευνο-εσ-τατος*, *ευ-νουσ-τατος*.

The ensuing four adjectives in -αίος—namely, *γεραιος*, old; *παλαιος*, of old, ancient; *περαιος*, belonging to the other side (of the river); *σχολαίος*, idle—take the endings -τερος and -τατος, without any connecting vowel, as—

Positive.	Comparative.	Superlative.
γεραι-ος.	γεραι-τερος.	γεραι-τατος.

Note that *φίλος*, loving, commonly has in the comparative *μαλλον φίλος*, and in the superlative *φιλάτος*.

The following adjectives in -ος—namely, *εὔδιος*, fair (weather); *ἥσυχος* (δ and η), quiet; *ἴσος*, like; *παράλησιος*, similar; *οὐβριος*, early (in the morning); *ὀψίος*, late; *πρωίος*, in the dawn—append the connecting syllable *αι* to the stem, so that the comparative and superlative exactly correspond to the forms of the preceding, as—

Positive.	Comparative.	Superlative.
μεσ-ος.	μεσ-αι-τερος.	μεσ-αι-τατος.

Two adjectives in -ος—namely, *ερρῶμενος*, strong, and *ἀκράτος*, unmixed—append the connecting syllable *εσ* to the stem, as *ερρῶμεν-εσ-τερος*, *ερρῶμεν-εσ-τατος*; *ἀκρατ-εσ-τερος*, *ἀκρατ-εσ-τατος*. So *αἰδώς*, -α, -ον, modest, has in the superlative *αἰδο-εσ-τατος*.

The following four adjectives in -ος—namely, *λαλός*, talkative; *μονοφαγός*, eating alone; *οὐοφαγός*, fond of good eating; and *πτωχός*, poor, begging—take *ισ* for their connecting syllable, as *λαλ-ισ-τερος*, *λαλ-ισ-τατος*.

Adjectives in -ης (gen. -ου), after dropping the *ης*, take the connecting syllable *ισ*, as—

Positive.	Comparative.	Superlative.
κλεπτ-ης, thievish.	κλεπτ-ισ-τερος.	κλεπτ-ισ-τατος.

So also one in -ης of the third declension—namely, *ψευδής*, -ες (gen. -εος, -ους), false—makes *ψευδιστερος*, *ψευδιστατος*.

VOCABULARY.

Αγαλλω, I adorn; in the middle voice with the dative, I am proud of.	Αἰρετός, -η, -ον, chosen.	Βίαιος, -α, -ον, violent.
	Αριστείδης, -ου, δ, Aristides.	Δίκαιος, -α, -ον, just.
		Εθνος, -ους, τό, a people, nation.

Ἰνδός, -ου, δ, Indian.	Νομίζω (νομός), I think, I hold as customary.	Σπαρτιατικός, -η, -ον, Spartan.
Καλλίας, -ου, δ, Callias, a proper name.	Οὐδείς, -ερος, no one; οὐδέν, nothing.	Τίμιος, -α, -ον, honoured, esteemed, valuable.
Κυκλαψ, -ωπος, δ, Cyclops.	Πατρις, -ίδος, ἡ, one's mother country.	Χρησίμιος, -η, -ον, useful.
Λακεδαιμόνιος, -ου, δ, a Lacedæmonian.	Σιωπή, -ης, ἡ, silence.	

The English adverb of comparison *than* is represented by *ἢ* (Latin *quam*); thus, *the son is wiser than the father*, is in Greek, *δ υἱός σοφώτερος ἐστὶν ἢ ὁ πατήρ*. Another form of comparison drops the *η*, and instead, as in the previous instance, of having the same case after the *η*, *than*, as before it, puts the second noun in the genitive, as *δ υἱός σοφώτερος τοῦ πατρός ἐστιν*.

EXERCISE 53.—GREEK-ENGLISH.

1. Αριστείδης πτωχίστατος ἦν, ἀλλὰ δίκαιότατος.
2. Οἱ Κυκλωπες βίαιοτατοί ἦσαν.
3. Καλλίας πλουσιώτατος ἦν Ἀθηναίων.
4. Οὐδὲν σιωπῆς ἐστὶ χρησιμώτερον.
5. Σίγη πού ἐστιν αἰρτώτερα λόγου.
6. Οὐδὲν ἐστὶ σοφίας τιμωτέρου.
7. Σοφία πλουτοῦ κτήμα τιμωτέρου ἐστὶν.
8. Ἡ Λακεδαιμόνιαν διαίτα ἢ ἀλυσσάτη.
9. Οἱ γεραιότεροι τὰς τῶν νέων τιμαὶς ἀγαλλονται.
10. Ἡ πατρις τοῖς ἀνθρώποις φιλάτη ἐστὶν.
11. Οἱ Ἰνδοὶ παλαιάτων ἐθνῶν νομίζονται.
12. Ὁ παῖδες, ἐστε ἡσυχάζοντες.
13. Οἱ Σπαρτιατικοὶ γενναῖα ἐρρωμένεσθαι ἡσταν τῶν Ἀθηναίων.
14. Πολλοὶ τῶν χελιδόνων εἰσι λαλίστατοι.
15. Οἱ δούλοι πολλὰκις ψευδίστατοι καὶ κλεψίστατοι εἰσιν.

EXERCISE 54.—ENGLISH-GREEK.

1. The father is wiser than the son.
2. The mother is more talkative than the daughter.
3. Virtue is the most valuable possession.
4. Socrates was the wisest Athenian.
5. The Athenians were wiser than the Lacedæmonians.
6. No one of the ancient Greeks was wiser than Aristides.
7. Men are quieter than boys.
8. The Lacedæmonians were very strong.
9. Swallows are very chattering.
10. The raven is very thievish.
11. Socrates' manner of life was very simple.

ADJECTIVES OF THE THIRD DECLENSION.

In adjectives of the third declension, the comparison-forms are added to the adjective stem, either immediately or by means of the connecting syllable *εσ* or *ισ*. The adjective stem appears in either the neuter or in the genitive, after the removal of the termination -ος.

The adjectives in -us, -eia, -v: in -ης, -ες; in -ας, -αυ, as well as μακάρι, blessed, affix the comparison-forms immediately to the stem; as—

Positive.	Neutr.	Comparative.	Superlative.
γλυκός, sweet.	-υ.	γλυκυ-τερος.	γλυκυ-τατος.
ἀληθής, true.	-ες.	ἀληθεσ-τερος.	ἀληθεσ-τατος.
πενής, poor.	-ες.	πενεσ-τερος.	πενεσ-τατος.
μέλας, black.	-αν.	μελαν-τερος.	μελαν-τατος.
μακάρι, blessed.	-αρ.	μακαρ-τερος.	μακαρ-τατος.

The adjectives ἡδύς, sweet, ταχύς, swift, and πολὺς, much, take the second comparison-forms, namely, those in -ίων and -ων.

The adjectives in -ων, -ον (gen. -ονος), assume the connecting syllable *εσ*; for example, *εὐδαίμων* (nom. -ον), fortunate, happy.

Positive.	Neutr.	Comparative.	Superlative.
εὐδαίμων.	εὐδαίμων.	εὐδαίμων-εσ-τερός.	εὐδαίμων-εσ-τατός.

Adjectives in -ιξ take as their connecting syllable partly *εσ* partly *ισ*, as—

ἀφελής,	Genitive, ἀφελίκος, growing old.
	Comparative, ἀφελικ-εσ-τερος.
	Superlative, ἀφελικ-εσ-τατος.
ἀρπαξ,	Genitive, ἀρπαγ-ος, robbing.
	Comparative, ἀρπαγ-ισ-τερος.
	Superlative, ἀρπαγ-ισ-τατος.

The adjectives in -εις, -εν, whose stem ends in *ντ*, append the terminations -τερος and -τατος immediately to the stem; but in the coming together of two *ντ*'s the first changes into *σ*, whereon the foregoing *ν* is dropped; the process and the result may be presented thus:—

Pos. χαριεις, -εν.	Gen. χαριεντ-ος, pleasing.
	χαριεντ-τερος.
	χαριεντ-τατος.
Com. χαριεσ-τερος.	Sup. χαριεσ-τατος.

Compounds of *χαρις* interpose *ω*, as—

Pos. επιχαρις, -ι. Gen. επιχαριτ-ος, pleasing.
Com. επιχαριτ-ω-τερος. Sup. επιχαριτ-ω-τατος.

VOCABULARY.

Αἰτνη, -ης, ἡ, Aetna.	Εὐσεβής, -ες, pious.	Ὀρμη, -ης, ἡ, impulse.
Αἰψά, suddenly.	Εὐχαρις, -ι (gen. -ιτος), attractive.	Ὀργή, -ης, ἡ, eagerness, zeal.
Ἀσθενής, -ες, powerless, weak.	Ἡβη, -ης, ἡ, youth.	Ὀυδὲ, nor, not even.
Ἀτυχία, -ας, ἡ, misfortune.	Κριτίας, -ου, δ, Critias.	Παρερχομαι, I pass by.
Ἀφροδίτη, -ης, ἡ, Aphrodite (Venus).	Μεσότης, -ητος, ἡ, the middle, moderation.	Πρεσβύς, δ (the only cases besides the nom. are acc. presbύ, and voc. presbύ; in the plural, presbεις), old, an old man.
Βάρυς, -εια, -υ, deep.	Νοημά, -άτος, τό, a thought (something in the nous, mind).	Ὀκύς, -εια, -υ, swift.
Βαρυς, -εια, -υ, heavy, burdensome.	Ὀρθός, -η, ον, straight, right.	
Εγκρατής, -ες, self-controlled, abstinent.		

EXERCISE 55.—GREEK-ENGLISH.

1. Αἰψά, ὡς νοημά, παρερχεται ἡβη, οὐδ' ἵππων ὄρμη γίγνεται ταχύτερα.
2. Τὸ γῆρας βαρυτέρον ἐστὶν Αἰτνῆς.
3. Ὁ θάνατος τῶν βαθυτάτων ὑπὸν παραλησιώτατος ἐστὶν.
4. Οἱ νέοι τοῖς τῶν πρεσβυτέρων ἐπαίνοις χαίρουσιν.
5. Φιλίας δικαίας κτήσις ἐστὶν ἀσφαλέστατη.
6. Ἡ μεσότης ἐν πᾶσιν ἀσφαλέστερα ἐστὶν.
7. Οἱ γερνότες ἀσθενέστεροι εἰσι τῶν νέων.
8. Βουλῆς ὀρθῆς οὐδὲν ἐστὶν ἀσφαλέστερον.
9. Οἱ κοράκες μελαντατοὶ εἰσιν.
10. Σακρατής ἐγκρατέστατος ἦν καὶ σωφρονεστάτος.
11. Ἐν ταῖς ἀτυχίαις πολλὰκις οἱ ἀνθρώποι σωφρονεστέροι εἰσιν, ἢ ἐν ταῖς ἐντυχίαις.
12. Κριτίας ἦν ἀρπαγίστατος.
13. Ἀφροδίτη ἦν χαριεστάτη πᾶσων θεῶν.

EXERCISE 56.—ENGLISH-GREEK.

1. Old age is very burdensome.
2. Nothing is swifter than thought.
3. Moderation is the safest.
4. No bird is blacker than the raven.
5. The boy is swift, the man is swifter, the horse is swiftest.
6. Youth is more attractive than old age.
7. The Ethiopians are very black.
8. No one of the Athenians was more self-controlled than Socrates.
9. Critias was more given to plunder (robbing) than Alexander.
10. Nothing is more pleasing than beautiful flowers.

LESSONS IN GEOLOGY.—III.

GEOLOGICAL AGENTS.—RAIN.—SPRINGS.—WELLS.

HAVING given a general idea in the last chapter of the appearance which stratified and unstratified rocks present, we proceed to answer the natural question, What causes have contributed to the composition of these rocks, and by what means have they been placed in their present positions?

We shall confine our attention first to the stratified rocks. These rocks owe their existence to aqueous action. A casual acquaintance with their appearance is sufficient to indicate this; but as we proceed we shall find that they contain, in a fossil state, innumerable remains of animal and vegetable life; and that these are so universally the remains of marine and aquatic life, that when the fossil of a land animal or a bird is discovered, it is considered a rare exception to the rule. No other proof is required beyond this of the fact that stratified rocks were once sediment, deposited at the bottom of seas and lakes; in the course of their accumulation, shells, dead fish, occasionally the body of a land animal brought down by a river, sea-weeds, corals, etc., became embedded in the sediment, and by processes, to be described in due time, impressions were taken of them in the matter of the deposit then being made, and they are presented to us as fossils, a word which is derived from the Latin *fossus*, "dug up."

This action is now going on, and there is no reason for believing that it has ever varied, but that existing causes have been the agents by which all the stratified rocks have been produced.

Geologists have only lately arrived at this conclusion. At first sight, many facts seem to oppose it. For when the fossiliferous strata are arranged in chronological order—that is, when they are piled one above the other in the order in which they were deposited—the series does not, as we might expect, present a gradation of rocks gradually passing from one mineral character to another, and containing animal and vegetable

remains, which indicate slow changes of species, but we pass directly from highly inclined strata to systems resting horizontally upon them—from rocks of one mineral composition to those of a totally different character—from an assemblage of organic remains in one stratum, to find in its neighbour immediately above it a world of life well nigh totally distinct, and only possessing a few species in common with it. These facts were understood to indicate that the surface of the earth had been subject to catastrophes, which overwhelmed the existing orders of life. These periods of disorder were succeeded by ages of repose, during which the usual order of things continued, new strata were deposited on the shattered and upheaved crust, and new species of life arose from the wreck of the overthrown world. But do the observed facts demand such a theory for their explanation? Suppose, for example, that Wales—where the oldest stratified rocks are developed, the Silurian—was now submerged, and upon the present land a deposition of sediment was made, in which specimens of the various animals now living in the Irish Channel were fossilised; and suppose that, in process of time, the upheaving force lifted the ocean-bed, and it became again dry land, whose surface was studied by the then existing race of geologists: what would be the facts which presented themselves? A series of strata reposing horizontally upon rocks of a distinct mineral character, which were highly inclined; the fossils of the upper rocks being utterly distinct from those of the lower. Would they then be warranted in coming to the conclusion that when the period of the deposition of the Silurian had come to an end, a mighty convulsion upheaved the strata, killed all existing life, and that a new creation peopled the seas with new types of life? We see how erroneous such a speculation would be.

The student must bear in mind a few prominent truths, which we shall illustrate, from facts observation has procured.

1. That no rocks can be formed on dry land. Hence the surface of the earth may be divided into areas of deposition and of non-deposition.

2. That in the making of rocks no new matter is used; it is only a re-arrangement of materials already in existence.

3. That the material deposited in one place represents the degrading action which has taken place in another.

4. That at all times there have been continents and seas, for in every class of rocks we have fossil evidence of the existence of land; and that the wearing down of the continents has been the chief source of the sediment deposited upon the ocean-bed.

5. That the earth's crust has from all time been subject to local upheavings and subsidings, which have now caused the ocean-bed to become dry land, and now the dry land to be submerged. Thus, with the exception of those localities where the primary rocks lie exposed, the whole surface of the earth has alternately served as "an area of deposition," or of "non-deposition." And even with regard to the primary rocks which now form the surface, we cannot declare positively that they never were submerged, for they may have been covered with sedimentary strata which has subsequently been washed off; though this may generally be decided by the appearance of the face of the rock. These are the main principles which observation of existing causes has enunciated. We shall treat of those causes in the order of their observation, taking the most important agent first.

THE GEOLOGICAL ACTION OF WATER.

Rain.—The atmosphere is capable of holding in solution a vast quantity of water. When its temperature is raised, this capability of holding moisture is greatly increased; on the other hand, if by any cause its temperature be decreased, the moisture it contains first condenses into clouds; and if the temperature fall still lower, the minute globules of which the clouds are composed coalesce into drops, and descend to the earth as rain.

The amount of water thus suspended in the firmament above us is beyond our conception. A thunder shower even has been known to pour down upon a limited area as much as 200,000 tons of water in a few hours.

The fall of rain varies with localities. In the equatorial regions Humboldt calculates that 96 inches fall annually. Here the great solar heat causes the distillation of the ocean-waters to be carried on with vigour. At a latitude of 45°, the rain-fall is only 29 inches; and 15° further north, 17 inches. In the

British Islands the average is about 36 inches; but even in our small island the difference of the rain-fall in neighbouring localities is very remarkable: for instance, at Whitehaven, in Cumberland, there fell, in 1849, 32 inches; while in the Vale of Borrowdale, only 15 miles distant, the fall was 142 inches—almost four times the amount. This is due to the position of the valley; it is traversed by the prevailing winds, which come loaded with moisture from the sea. The mountains condense this moisture, and the valley receives the rain.

The most remarkable instance of this combination of local causes is perhaps found in the case of the Khasia Hills, which

form the southern side of the valley of the Brahmapootra, just as it enters the delta of the Ganges. These mountains are some 4,000 or 5,000 feet high, and their south flank looks over the delta towards the Bay of Bengal. When the south monsoon blows, it traverses the river-flats, and arrives at the foot of the Khasias loaded with moisture. Impinging upon the mountains, it is driven upwards; it rises into colder regions, and to a height at which the air is greatly rarefied. Now, when air is rarefied, it acquires a greater power of containing heat, and consequently it absorbs its own sensible heat, and thus its temperature falls. From the combination of

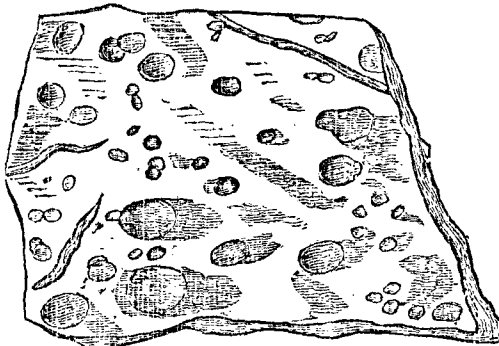


FIG. 7.—RAIN-PRINTS AND WORM-TRACKS IN CARBONIFEROUS GREEN SLATE.

these causes the monsoon delivers up its moisture, and as much as 600 inches of rain fall on the south flank of the Khasias yearly. The denuding effect of this vast quantity of water is greatly enhanced by the fact that it almost all falls in the six months in which the monsoons blow. In many tropical countries the fall averages 200 inches. Just as there are combinations of local circumstances which produce unusual rain-falls, so there are regions where the opposite effect is the result. Rainless regions are found generally in the centres of vast continents. Ere the winds reach these localities they have been dried, the moisture they carried having been condensed by mountains which intervened between the seas and the centre of the continent. There is a strip of coast-line in Chili and Peru where no rain falls, for the prevailing winds deposit their moisture on the opposite flank of the Andes, and when they reach the countries to the leeward they are dry. No rain has fallen here for years, as may be proved by the fact that houses are built of "Chili saltpetre," or sodium nitrate, which is a salt soluble in water; hence the existence of the structures is a testimony to the rainless climate. Considering that every drop of rain does a geological work—it either carries down a grain of sand to a lower level, or soaks into the soil, loosening it for the action of the next shower—it may be conceived what a vast and universal work is being carried on by drops of rain. If it required proof that the surface of the earth had always been subject to the action of rain, we should find it in the frequent discovery of rain-prints in some of the oldest systems. Many specimens of these interesting remains have been found in rocks of the Carboniferous period. During the age in which the coal-fields were deposited, the atmosphere—to encourage the rapid growth of the dense vegetation which characterised that epoch—must have been highly charged with moisture, and, as a consequence of this, showers of rain must have been of constant occurrence.

Fig. 7 shows a slab exhibiting rain-prints and worm-tracks, discovered in the carboniferous green slate in Nova Scotia. Sir Charles Lyell has most satisfactorily explained the presence of these rain-prints. His observations were made on the shores of the Bay of Fundy, where the tide rises higher than any other place in the world—more than 70 feet. The extensive mud-flats are left dry for the period between the high tides. If a shower fall while the mud is yet soft, an impression is made, which the hot sun bakes into an enduring cast, so that when the next high tide covers the flat the rain-prints are not

effaced, but a layer of mud is deposited upon them. In process of time this becomes rock, and when split the rain-prints are exhibited, faithfully registering the fact of the shower, and frequently showing the direction of the wind, by the cavity formed by the drop being deeper on that side to which the drop was driven.

Springs.—Not satisfied with the work done as individuals, the rain-drops seek to combine their power, and collecting in cavities in the hills, and in the more porous rocks, form springs which permanently feed rivers. Although the degrading action of springs cannot be compared to that of rivers, yet it is by no means despicable; their action is continuous, and every spring wears for itself a valley, of greater or less size, according to the length of time it has flowed, the quantity of water it discharges, and the nature of the rock from which it issues.

The origin of one class of springs will be at once conceived by watching a child dig a hole on the sea-beach. The retiring tide has left the sand saturated with water, which drains into the hole and soon fills it. This is precisely the case with porous rocks soaked with rain-water. If a well be sunk down to the base of such a rock, where a less porous stratum underlies it, water will soon rise in the excavation. Now suppose there exist some fissure in the rock, we have at once a natural well; and as soon as an outlet is found, which is at a lower level than the surface of the water, a spring will be the result. Springs will be plentiful at the outcrop of a layer of clay, or some other deposit impervious to moisture, above which lies a porous rock, such as chalk or sandstone, which will retain the rain. The reason why there is not an issue of water from the whole line of the outcrop of the impermeable strata is that the water follows the valleys formed by the inequalities of the surface of the strata, so that where a spring does occur, we may conclude that that is the end of a valley of which the spring may be conceived to be the river. In this instance the valley made the river, and not the river the valley.

Artesian wells have thrown some interesting light on the underground system of waterworks. These wells or borings are made by an auger generally about four inches in diameter. When rock is reached, it is triturated by an iron rod, and the debris removed by the auger. The sides of the bore are protected by sinking iron pipes. The boring is continued until a porous stratum is reached. The Artesian wells in the neighbourhood of London are sunk to reach the chalk, and are about 320 feet deep, and they yield some 15,000,000 gallons a day; but the water does not rise so high in the well as it used, proving that the chalk reservoir is not inexhaustible.

There is a well at Grenelle, near Paris, 1,800 feet deep. Frequently, in the course of the boring, a subterranean cavity is tapped, from which the water rises with great force. At Tours, when the depth of 364 feet was reached, there was a sudden rise of water, which brought up with it a quantity of sand, shells, branches of thorns, seeds, etc., and there was reason to believe that these came from some of the valleys of Auvergne, 150 miles distant, proving a cavernous connection between the two places.

Fig. 8 represents an ideal section of the London basin: a is a "surface well," H, an Artesian well. The water from a looks sparkling, and is more refreshing than from H; and is delicious just in proportion as these qualities recommend it, for they are due to organic matter and nitrates, which the rain gathers as it comes into contact with decomposing animal matter on the surface; whereas the water from H enters the chalk strata, A A, far out in the country.

Artesian wells derive their name from Artois, in France, where they were first sunk.

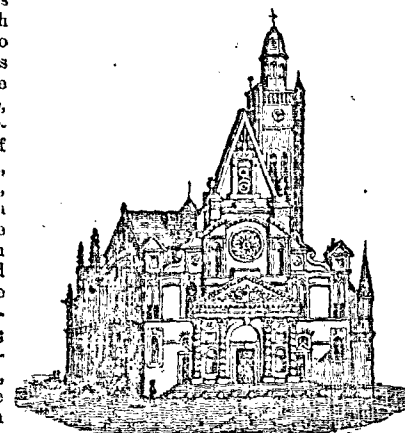


FIG. 8.—IDEAL SECTION OF LONDON BASIN. AA, CHALK; BB, CLAY; C, GRAVEL; a, SURFACE WELL; H, ARTESIAN WELL.

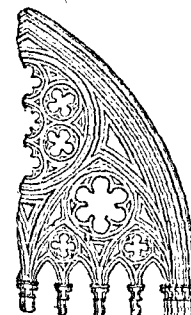
LESSONS IN ARCHITECTURE.—XII.

GOthic ARCHITECTURE.

In our last lesson we spoke of the rise, decline, and fall of Gothic architecture. Its origin, like that of some other styles, has not been so correctly ascertained as to render its historical details of much interest. It is certain that it began to be employed in ecclesiastical edifices about the time that the Goths were settled in Italy, and had been overcome, in their turn, by the nations which superseded the Romans. This system of architecture, as we have already said, was practised during the Middle Ages, and continued in use till the sixteenth century, when it was supplanted by the revival of the Roman style. It was then called Gothic from the architects and workmen who were supposed to have been engaged in the planning and erecting the edifices which bear this name; and it was held in contempt by the followers of Palladio, in Italy, and of Jones, in England. The Gothic architecture differs essentially from the Greek, both in construction and appearance. In the latter the arrangement of the materials depended on their strength in masses,



CHURCH OF ST. ETIENNE DU MONT, PARIS.



WINDOW OF 13TH CENTURY.

its spires and pinnacles, and its decorations, which excel the latter in variety, number, and minuteness.

Among the theories which have been proposed to account for the origin of this style, we may mention an ingenious one which has been suggested by Sir James Hall, in his "Essay on the Origin, Principles, and History of Gothic Architecture." He conceives that the forms of this style may have been derived from the imitation of a rustic dwelling, constructed in the following manner: Thrust two rows of posts into the ground opposite to each other, at an interval equal to that between the posts in the rows themselves, each post rising to the height of about three intervals. Apply to each post a set of slender rods of willow, thrusting them into the ground at its base, and tying them in two places, one a little above the ground, and the other within about a third part of the height, leaving them loose from this point upwards, so that they may be freely used in any direction. The rods may be three in number to each of the outside corner posts, and five to each of the others, all being placed so as to cover the inside of the posts, and give it the appearance of a bundle of rods. It will be easy now to form the skeleton of a thatched roof. For this purpose let a rod from each of two opposite posts be bent at its loose top, so that

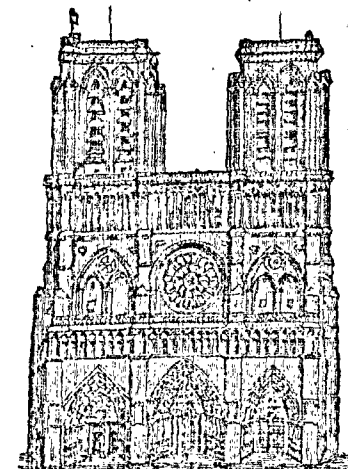
they may cross each other, which gives us the form of a pointed arch; and the same being done throughout the whole extent of the two opposite rows, an horizontal rod, or ridge bar, being at the same time placed along the points of crossing, we have the appearance of a Gothic arcade. Two rods from each post in the same row are now to be treated in like manner, so as to form similar arches in both rows, and these are also to be connected by ridge bars crossing the longitudinal one. Having now employed two rods of each corner post, and three of each intermediate one, there still remain one in the former, and two in the latter, which may be disposed of by causing them to pass diagonally from the corners of each rectangle, not crossing as in the former cases, but applied side by side, so as to form a continued hoop or semicircle. In this manner all the rods are occupied, and a frame is produced capable of supporting thatch or other covering. From the imitation of a dwelling so constructed the three leading characters of Gothic architecture may be traced, namely, the pointed arch, the clustered column, and the branching roof. On principles similar to these the ingenious author endeavours to account for the peculiarities of the Gothic windows, doors, spires, etc. But it is much to be doubted whether any theory so simple and ingenious as the preceding will account for the origin of a style which emanated from the numerous and

varied applications of the arch, whether semi-circular or pointed, whether composed of segments of circles crossing each other, or of other curves corresponding to Hogarth's celebrated line of beauty, which was evidently traced by him in the ogee or cyma (Greek κυμα, ku'-ma, a wave) of the ancient Greek and Roman architecture, as well as in the Gothic. This curve is in the form of the letter S without its top and bottom appendages, thus S.



WINDOW OF 15TH CENTURY.

In the churches of the Middle Ages, there were to be seen, as indicated in the preceding theory, endless groups of small columns, immense domes, complicated buttresses, lofty roofs, with bell towers, and other appurtenances. The finest examples in Europe of the Gothic, or ogival style of architecture, are the great cathedrals of Notre Dame at Paris, Bourges, Amiens, Chartres, Rouen, and Rheims. This style, as we have observed, at first pure and simple, and formed of regular curves, became so distorted at the close of the short period of its existence, as to lose its very nature, and it then led to the invention of all the extravagant productions which arose from compound arches, which were only a degradation of the original style, and which soon caused its abandonment. It would be impossible to exhibit, in diagrams, the innumerable details in architecture and of sculpture which the beautiful edifices of the Middle Ages present, all characterised by the use of the pointed arch. We give, however, two specimens of the rich ornamentation which crowded the windows and capitals of the columns in the Gothic churches of the thirteenth and fifteenth centuries. In the sixteenth century, the Greek and Roman arts and architecture returned, but only by a gradual transition, that for a length of time the pointed arch was employed in the construction of domes, and of some other important parts of the edifice, of



CATHEDRAL OF NOTRE DAME, PARIS.

which the churches of St. Eustache, and of St. Étienne du Mont, at Paris, are examples. In castles built at this period of the Renaissance, such as those of Fouen and of Gaillon, the chapel was Gothic, whilst the rest was classical. The ancient architecture has extended its power over the civilised world, from the Renaissance period to the middle part of the present century, when a reaction took place in favour of the Gothic style of architecture, especially for ecclesiastical buildings.

The severe study of the monuments of Greece and Italy in modern times, tends to preserve and extend the taste for the ancient orders of architecture, as being more durable in their effects, more easy in their construction, and more economical in their expenditure, than the Gothic style. The recent desire to restore the architectural monuments of the Gothic period, has led to an extraordinary study of its ancient examples, and has produced in some enthusiastic minds a wish to substitute this style of architecture for those which have regulated the splendid edifices of Europe for three centuries. Without attempting to depreciate a style which is considered particularly adapted to religious edifices, it is difficult to imagine that it will prevail, for any lengthened period, over those orders of architecture which, by their strength and solidity as well as massive elegance, far surpass their resuscitated rival.

In one of the annexed engravings, the reader will find a representation of one of the finest examples of the true Gothic style of architecture already mentioned, viz., the Church of Notre Dame, at Paris. This metropolitan church of the French capital is said to have been built on the ruins of a heathen temple, and to have been founded during the first ages of Christianity. Its reconstruction was begun by Maurice Sully, in 1163, and the first stone was laid by Pope Alexander III. Jean de Chilles, master of works, undertook the south front in 1257; the north front was constructed in 1312, by means raised by the knight-templars. Charles VII., in 1447, gave considerable sums for the completion of this cathedral. The first stone of the great altar was laid in 1669, by Cardinal Noailles; and the choir, then begun from the designs of Mansarde, was only finished in 1714. The celebrated bell of Notre Dame, the largest in France, is placed in the south tower; it was founded in 1685, and set up by Louis XIV. The cathedral was restored during the reign of Napoleon III., the massive iron railing by which it is surrounded being completed in 1868.

In this lesson is also given a representation of one of the finest examples of those churches which belong to the transition period mentioned above, namely, the Church of St. Étienne du Mont. This church was known by the same name in 1221. It was reconstructed about 1517; but the aisle and the south chapel were built in 1588. The western parts were only finished under Charles IX. The communion chapel was built in 1606, and Margaret of Valois, first wife of Henri IV., laid the first stone of the front. These circumstances explain the mixture of the Gothic style with that of the Renaissance which is found in this church. It is the only church in Paris furnished with a gallery; and is decorated with very remarkable windows, the work of Pinagrier, a celebrated artist of the sixteenth century.

LESSONS IN FRENCH.—XLIII.

SECTION XCV.—IDIOMS RELATING TO MONDE, GENS, ETC.

1. The word *monde*, *world*, is often used in French in a restricted sense. It has then the meaning of *people*, *company*, *retinue*, *servants*, &c. :—

Y avait-il beaucoup de monde à l'église? Were there many people at church?
Se mettant à la tête de son monde, il ouvrit lui-même la porte. Placing himself at the head of his people, he himself opened the door.
VOLTAIRE.

2. The word *gens* also means *people*, and is of the masculine gender; but, by a singular anomaly, the adjectives which precede gens are put in the *feminine*, while those which follow it must be in the *masculine* gender :—

Ce sont les meilleures gens du monde. They are the best people in the world.
Ces gens sont fort dangereux. Those people are very dangerous.

3. The words *tout*, *tel*, *quel*, *certain*, not preceding immediately the word *gens*, are put in the masculine, except when the word coming between is an adjective having a different termination in the two genders :—

Tous ces gens-là étaient-ils chrétiens? Were all those people Christians?
PASCAL.
Tous ces gens-là sont sottement ingénieux. All those people are foolishly ingenious.
J. J. ROUSSEAU.

4. The words *tout*, *tel*, *quel*, *certain*, are put in the feminine when they precede immediately the word *gens*, or are separated from it by an adjective having a different termination in the feminine :—

Quelles gens êtes-vous? Quelles sont vos affaires? What people are you? What is your business?
RACINE.
Quelles bonnes gens! What good people?

However, when *tout*, although immediately preceding *gens*, refers to a noun masculine and not to *gens*, it is used in the masculine :—

Ces moines, tous gens de santé. Those monks, all of them men of robust health.

MISCELLANEOUS EXAMPLES.

Après s'être fait craindre de tout le monde, il craignit tout le monde aussi. After having inspired everybody with fear, he feared everybody.
FLÉCHIER.

Il dit du mal de tout le monde. He slanders everybody.
Tout le monde le dit. Everybody says so.

Avez-vous amené beaucoup de monde? Have you brought many people?

Le monde n'est pas encore arrivé. The company is not yet come.
Il n'y avait pas grand monde. There were not many people there.
Il y a du monde avec lui. There is some person with him.

Il a congédié tout son monde. He has discharged all his servants (people).
Ce capitaine a tout son monde. That captain has all his crew.

Voilà de sottes gens. Those are foolish people.
Il s'arrête chez les premières bonnes gens qu'il trouve. He stops with the first good people that he finds.

Il y a à la ville, comme ailleurs, de fort sottes gens, des gens fades, oisifs, désoccupés. There are in the city, as elsewhere, very silly people, tedious, idle, unemployed people.
BOISTE.

Quels braves gens! What worthy people!
Quelles viles et méchantes gens! What vile and wicked people.
LA BRUYÈRE.

EXERCISE 185.

Accommoder (s'), 1. Equipage, m. crew. Rassembler, 1. to bring ref. to put up with, together.
à agréer with. Éveiller, 1. to awake.
Attendre, 4. to await, Gens de lettres, men. Revenir, 2. ir. to return.
to expect. Gens d'épée, military men. Salon, m. drawing-room.
Bord (à), on board. Gens de robe, lawyers. Servir, 2. ir. to serve.
Campagne, f. country. Patron, m. patron. Terre, f. land, shore.
Démêler, 1. to settle, saint. Voyager, 1. [48] to arrange. travel.
Dès que, as soon as. Perdre, 4. to lose.

1. Avez-vous rassemblé beaucoup de monde chez vous? 2. Il n'est venu que peu de monde. 3. À quelle heure servira-t-on le dîner aujourd'hui? 4. On le servira dès que notre monde sera venu. 5. Le capitaine a-t-il tout son équipage à bord? 6. Non, Monsieur, il a envoyé du monde à terre. 7. Vos gens se lèvent-ils de bonne heure? 8. Il faut que tous les jours j'éveille tout mon monde (MOLIÈRE). 9. Les Moscovites perdirent trois fois plus de monde que les Suédois (VOLTAIRE). 10. Où est Madame votre mère? 11. Elle est dans le salon, il y a du monde avec elle (company). 12. Tout le monde veut voyager comme moi (X. DE MAISTRE). 13. Ainsi va le monde. 14. Elle attend pour quitter le monde, que le monde l'ait quittée (FLÉCHIER). 15. Vos gens sont-ils revenus de la campagne? 16. Nous attendons nos gens aujourd'hui. 17. Y a-t-il ici une société de gens de lettres? 18. Non, Monsieur; il n'y a qu'une société de gens de robe. 19. Connaissiez-vous ces braves gens? 20. Je crois que ce sont des gens d'épée. 21. Tels sont les gens aujourd'hui. 22. Telles gens, tels patrons (LA BRUYÈRE). 23. Tous mes gens sont malades. 24. Il faut savoir s'accommoder de toutes gens (L'ACADÉMIE). 25. Que pouvez-vous avoir à démêler avec de telles gens?

EXERCISE 186.

1. Are there many people at your brother's? 2. There are not many people there. 3. Does that young man slander everybody? 4. He slanders nobody. 5. Have you brought many people with you? 6. We have brought but few people with us. 7. Is there company with your mother? 8. There is no company with her. 9. Who has told you that? 10. Everybody says so. 11. Is the company come? 12. The company is not yet come. 13. Has your mother discharged two servants (domestiques)? 14. She has discharged all her people. 15. Do you know those people? 16. I know them very well; they are very worthy people. 17. When he travels, he stops always with good people. 18. Are there foolish people here? 19. There are foolish people everywhere (partout). 20. Do you awake your people every morning? 21. Yes, Sir; I must awake them every day. 22. What can your brother have to settle with those people? 23. They are the best people in the world. 24. Were there many people at church this morning? 25. There were not many people there. 26. Are your people ill? 27. Yes, Sir; all my people are ill. 28. There is here a society of learned men. 29. There are in Paris several societies of lawyers. 30. What worthy people! 31. What good people! 32. Do you expect your people to-day? 33. We expect them this evening. 34. So goes the world. 35. Has your captain all his crew? 36. He has all his crew on board.

SECTION XCVI.—IDIOMS RELATING TO EN, ENTENDRE, ETC.

1. When property or possession is affirmed of things inanimate, the relation of possession is expressed by the relative pronoun *en* when the thing possessed is not in the same clause as the inanimate possessor [§ 92 (5)] :—

Voilà un bel arbre; le fruit en est excellent. That is a fine tree; its fruit is excellent.

2. When, however, the inanimate possessor and the thing possessed are in the same clause, the possessive adjective is used [§ 92, (4)] :—

Cet arbre a perdu son fruit. That tree has lost its fruit.

3. *Entendre*, to hear, is used in the sense of *to understand*. It is also used reflectively. It means then, *to be understood*, *to understand one's self*, or *one another*, or *to agree with one another*. It means also, *to be expert in anything*. In this latter sense it takes à before its object, which may be replaced by the pronoun *y* :—

Comment entendez-vous cela? How do you understand that?
Cela s'entend. That is understood.
Il s'entend aux affaires. He is expert in business.

4. *Se faire entendre* corresponds to the English, *to make one's self understood*, *to make one's self heard* :—

Nous nous sommes fait entendre. We made ourselves understood, or heard.

5. *Taire* [4. ir.] means, *to conceal*, *to keep to one's self*. *Se taire*, ref., *to be silent*.

Taisez-vous. Taisons-nous. Be silent (hold your tongue). Let us be silent.
Dites-lui de se taire. Tell him to be silent.

MISCELLANEOUS EXAMPLES.

L'auteur d'un bienfait est celui qui en reçoit les plus doux fruits. The author of a good deed is the one who receives its sweetest fruits.
DUCROS.
Votre jardin est magnifique; les arbres en sont superbes. Your garden is magnificent; its trees are very beautiful.
La vie a ses plaisirs et ses peines. Life has its pleasures and its troubles.
L'étude a ses charmes. Study has its charms.
Entendez-vous bien le latin? Do you understand Latin well?
Cet avocat n'entend rien aux affaires. That attorney has no knowledge of business.
Il ne s'y entend pas. He is not expert in this.
Je lui ai donné à entendre qu'il était de trop ici. I gave him to understand that he was in the way here.
Il y avait tant de bruit, que nous n'avons pu nous faire entendre. There was so much noise, that we could not make ourselves heard.

Taisez le premier, ce que vous voulez qu'on taise. Keep to yourself that which you would wish others to keep secret.
Pourquoi ne vous taisez-vous pas? Why are you not silent?
Nous l'avons fait taire. We made him hold his tongue (silenced him).

EXERCISE 187.

Agrément, m. pleasure. Chirurgien, m. surgeon. Manche, f. sleeve.
Avantage, m. advantage. Consentir, 2. ir. to consent. Muet, m. dumb, mute.
Basque, f. skirt of a coat. Court, e. short. Pays, m. country.
Brave, worthy. Force, f. force, power. Raison, f. reason.
Fort, very. Réussir, 2. to succeed.

1. Est-ce un habit neuf que votre fils porte? 2. C'est un habit neuf, le drap en est très fin. 3. Les manches n'en sont-elles pas trop courtes? 4. Je crois que les manches en sont trop courtes et les basques trop longues. 5. La campagne n'a-t-elle pas ses avantages? 6. J'aime la campagne; j'en connais les avantages. 7. Paris a ses agréments. 8. J'aime Paris; j'en connais les agréments. 9. Ce chirurgien s'entend-il à la médecine? 10. Il n'y entend rien du tout. 11. Entendez-vous la médecine? 12. Je ne m'y entends pas. 13. Je ne l'entends pas. 14. Je n'y entends rien. 15. Avez-vous réussi à vous faire entendre? 16. Nous n'y avons pas réussi. 17. Mon voisin est un brave homme, et je m'entends fort bien avec lui. 18. Faire taire certaines gens est un plus grand miracle que de faire parler les muets (BALZAC). 19. Savez-vous de quel pays est cet homme? 20. Il tait son pays et sa naissance. 21. Par la force de la raison, elle apprit l'art de parler et de se taire (FLÉCHIER). 22. Voulez-vous vous taire, impertinente, vous venez toujours mêler vos impertinences à toutes choses (MOLIÈRE). 23. Qui se tait consent (PROVERB).

EXERCISE 188.

1. Have you a very good garden? 2. We have a very large one, but its soil (terre, f.) is not good. 3. Is your brother's coat new? 4. He has a new coat, but its sleeves are too short. 5. Are not its skirts too long? 6. No, Sir; its skirts are too short. 7. Have you not heard that preacher (prédicateur)? 8. There was so much noise, that I could not hear him. 9. Does not the country have its pleasures? 10. The country has its pleasures. 11. Does not your brother like the city? 12. He likes the country; he knows its pleasures. 13. What does your brother mean by that? 14. He means what he says. 15. Is your father expert in business? 16. My father has no knowledge of business. 17. Does that young man understand English well? 18. He understands French and English very well. 19. Do you agree well with your partner? 20. My partner is an honest man [§ 86]; I agree very well with him. 21. Does that young man conceal his age? 22. He conceals his age and his country. 23. Does your father understand medicine? 24. He does not understand it. 25. He has no knowledge of it. 26. Be silent, my child. 27. Tell that child to be silent. 28. Silence gives consent. 29. Will you not be silent? 30. What have you given him to understand? 31. We gave him to understand that study has its charms. 32. Have you silenced him? 33. Yes, Sir; we silenced him. 34. Tell him to be silent. 35. I have already (djà) told him to be silent. 36. Let us be silent.

KEY TO EXERCISES IN LESSONS IN FRENCH.

EXERCISE 104 (Vol. I., page 394).

1. Aviez-vous peur, ce matin, quand vous êtes venu chez nous? 2. J'avais peur. 3. De quoi aviez-vous peur? 4. J'avais peur du cheval. 5. Votre ami n'avait-il pas peur de tomber? 6. Il n'avait pas peur de tomber, mais il craignait de se tromper. 7. Conduisiez-vous votre fils à l'école? 8. Je le conduisais à l'école. 9. De quelle couleur le teinturier teignait-il la soie? 10. Il en teignait en rouge et en vert. 11. Teignait-il sa toile en noir ou en vert? 12. Il ne la teignait ni en noir ni en vert, il la teignait en rose. 13. Qu'est-ce que le monsieur lisait? (Que lisait le monsieur?) 14. Il lisait une lettre qu'il venait de recevoir. 15. Aviez-vous froid quand vous êtes venu ici? 16. J'avais froid, faim et soif. 17. N'aviez-vous pas honte de votre conduite? 18. J'en avais honte. 19. Où alliez-vous quand je vous rencontrais? 20. J'allais chez vous. 21. Conduisiez-vous la voiture de M. votre frère? 22. Je conduisais la mienne. 23. Envoyiez-vous à mon père ou à moi? 24. J'écrivais à l'un de vos cousins.

EXERCISE 105 (Vol. I., page 405).

1. Did you not know where the musician was gone? 2. I knew that he was gone to Paris. 3. Had you not been told that your

brother is dead? 4. I had been told that he was dangerously sick. 5. Did you not generally go to bed as soon as you had finished your lessons? 6. As soon as I had finished them, I used to go to the play. 7. As soon as you had finished your lessons last evening, what did you do? 8. As soon as I had finished them, I went to the ball. 9. Had not that little girl a wish to sleep? 10. She had more wish to sleep than to study. 11. What had you done with your book when I asked you for it? 12. I had mislaid it. 13. I had forgotten it in the garden. 14. Why was your watch stopped? 15. Because I had forgotten to wind it up. 16. Had not the watchmaker wound it up? 17. He had forgotten to do it. 18. Had you not lost your purse? 19. I had lost it, but I have found it again. 20. Had your cousin left? 21. He had not left yet. 22. Was he out? 23. He was out with my mother. 24. Whither was he gone? 25. He was gone to my brother's, who had invited him to dinner.

EXERCISE 106 (Vol. I., page 405).

1. N'avez-vous pas eu l'intention de parler à mon frère? 2. J'avais eu l'intention de lui parler, mais il était parti. 3. Mlle votre sœur se couchait-elle, hier au soir, aussitôt qu'elle eut lu son livre? 4. Elle se coucha aussitôt qu'elle eut lu. 5. Vous avait-on dit que votre sœur était malade? 6. On m'avait dit qu'elle avait été dangereusement malade. 7. Saviez-vous ce que vous aviez fait de votre plume? 8. Je savais que je l'avais égarée. 9. Combien de vos livres avez-vous égarés? 10. J'en avais égaré cinq, mais mon frère les a retrouvés. 11. Où les aviez-vous laissés? 12. Je les avais laissés dans le jardin. 13. La montre de votre frère était-elle arrêtée? 14. Elle était arrêtée. 15. Pourquoi était-elle arrêtée? 16. Il avait oublié de la remonter. 17. N'avait-il pas perdu sa clef? 18. Il ne l'avait pas perdue. 19. Le teinturier était-il parti? 20. Il n'était pas encore parti, il avait l'intention de partir à cinq heures. 21. Lui aviez-vous parlé, quand j'arrivai hier? 22. Je lui avais parlé. 23. Lui aviez-vous dit que ma sœur est ici? 24. Je le lui avais dit. 25. Est-il encore ici? 26. Non, Monsieur, il est parti; il a parti ce matin à six heures.

EXERCISE 107 (Vol. I., page 405).

1. Where were your relations last year? 2. They were in England. 3. Where did the gentlemen remain who accompanied you this morning? 4. They remained at the house of their partners. 5. What were your friends reading when you left them? 6. They were reading the news which they had just received. 7. What does your father say? 8. He says nothing. 9. How old is that gentleman? 10. He is nearly fifty years old. 11. How old are your children? 12. The eldest is ten years old, and the youngest six. 13. Have you asked that gentleman for your gold chain? 14. I have asked him for it. 15. Have you returned to the clerk the money which he had lent you? 16. I have returned it to him. 17. Had you a wish to send the locksmith your keys? 18. I had a wish to send them to him, for they are broken. 19. Was it worth the while to send those bottles to the innkeeper? 20. It was worth the while to send them to him, for he had none. 21. Have you asked your father for napkins? 22. I would not ask him for any.

EXERCISE 108 (Vol. I., page 405).

1. Que vous disait le serrurier? 2. Il me disait qu'il a apporté ma clef. 3. Combien de lettres avez-vous portées à la poste? 4. J'en ai porté sept: trois pour vous, et quatre pour mon père. 5. Où est le monsieur qui a apporté cette lettre? 6. Il demeure chez mon père; voulez-vous lui parler? 7. Je voulais lui envoyer une lettre que j'ai apportée d'Angleterre. 8. Avez-vous rendu à cet homme l'argent qu'il vous avait prêté? 9. Je le lui ai rendu. 10. Avez-vous envie d'envoyer à M. votre frère la clef de votre chambre? 11. J'avais envie de la lui envoyer. 12. Cela valait-il la peine de donner ce livre à M. votre frère? 13. Cela valait la peine de le lui donner, car il en avait besoin. 14. Cela valait-il la peine d'envoyer ces bouteilles au pharmacien? 15. Cela valait la peine de les lui envoyer. 16. Où est le propriétaire? 17. Il est en Angleterre. 18. Combien d'enfants a le serrurier? 19. Il en a dix. 20. Combien de livres a le médecin? 21. Il a cinq cents volumes. 22. Avez-vous donné cette lettre au monsieur? 23. J'ai oublié de la lui donner.

EXERCISE 109 (Vol. I., page 406).

1. How long has Mr. L. lived in Paris? 2. He has been living there ten years. 3. Has he not lived in Lyons? 4. He lived there formerly. 5. Can you tell me where the captain's son is? 6. He has been in England one year. 7. Do you know where Mr. B. lives? 8. He lived formerly in Rouen; I do not know where he lives now. 9. Have you been here long? 10. We have been here more than two months. 11. How long have you had this orchard? 12. We have had it a year. 13. Do you know how far it is from Paris to Vienna? 14. It is three hundred and six leagues from Paris to Vienna, and two hundred leagues from Vienna to Copenhagen. 15. Has the company been here long? 16. It has been here more than two hours. 17. Is it long since you read this bill? 18. It is more than three hours ago that I read it. 19. Has not your sister been reading more than half an hour? 20. She has been reading so long, that she is tired of it. 21. Have you been waiting long for this piece of music? 22. I have been waiting for it more than a year.

LESSONS IN ALGEBRA.—IV.

SUBTRACTION.

56. SUBTRACTION is the finding of the difference between any two quantities or collections of quantities.

EXAMPLES.—(1.) Charles has 5a pears, and James has 3a pears. How many more pears has Charles than James?

In this example, we wish to take 3a pears from 5a pears. But subtraction is denoted by the sign —. Hence the expression 5a — 3a pears represents the answer. But 5a — 3a = 2a pears; which is the answer.

(2.) A gentleman owns a house valued at £4,500, but he is in debt £800. How much is he worth?

Here we have £4,500 — £800 = £3,700. Ans.

57. Let us now attend to the principle upon which these operations are performed. Let us suppose that you open a book account with your neighbour, and that when cast up, the debtor side, which is considered positive, is £500, and the credit side, which is considered negative, is £300. On balancing the account, you find that he owes you £500 — £300 = £200. Now, if you take £50 from the positive or debtor side, it will have the same effect on the balance, as if you added £50 to the negative or credit side; and on the other hand, if you take £50 from the negative or credit side, it will have the same effect on the balance, as if you added £50 to the positive or debtor side.

58. In like manner, if, in the expression 12a — 5a, you take 3a from 12a, it will have the same effect on the expression, as if you added 3a to 5a, and retained the negative sign in the sum; thus, 9a — 5a is the same as 12a — 8a. Again, if in the expression 12a — 5a, you take 3a from 5a, and retain the negative sign in the difference, it will have the same effect on the expression, as if you added 3a to 12a; thus, 12a — 2a, is the same as 15a — 5a.

59. Hence universally, taking away a positive quantity from an algebraic expression is the same in effect as adding an equal negative quantity; and taking away a negative quantity is the same as adding an equal positive one.

60. Upon this principle is founded the following

GENERAL RULE FOR SUBTRACTION.

Change the signs of all the quantities to be subtracted, i.e., of the subtrahend, or suppose them to be changed from + to —, and from — to +; then if the quantities are ALIKE, unite the terms as in addition (Arts. 49, 50); but if the quantities are UNLIKE, write the terms of the subtrahend after those of the minuend. (Art. 54).

Otherwise.—Put the quantity to be subtracted in brackets, and write it after the quantity from which it is to be subtracted, with the sign — between them; then apply the Rules of Addition.

EXAMPLES.

(1.) From 6a + 9b, take 3a + 4b.

Here, change the signs of the subtrahend, but not those of the minuend, thus:—
6a + 9b — 3a — 4b. Next reduce these terms, by Art. 52, and you have the answer, 3a + 5b.

(2.) From 16b (3.) 14da (4.) —28 (5.) —16b (6.) —14da

Take 12b 6da —16 —12b —6da

Answer, 4b 8da —12 —4b —8da

(7.) 16b (8.) 12b (9.) 6da (10.) —16 (11.) —12b (12.) —6da

28b 16b 14da —28 —16b —14da

—12b —4b —8da +12 +4b +8da

(13.) +16b (14.) +14da (15.) —28 (16.) —16b (17.) —14da

—12b —6da +16 +12b +6da

+28b +20da —44 —28b —20da

(18.) From 8ab, take 6xy. Ans. 8ab — 6xy.

(19.) From 6axy Take 17ay

Answer, 6axy — 17ay 16aax — 20ax

(21.) 6dd + 3d — 4dd

10dc + 2ddd + 4dy

6dd + 3d — 4dd — 10dc — 2ddd — 4dy

HISTORIC SKETCHES.

61. From these examples, it will be seen that the difference between a positive and a negative quantity may be greater than either of the two quantities. In a thermometer, the difference between 28 degrees above zero, and 16 degrees below, is 44 degrees. The difference between gaining 1,000 pounds in trade, and losing 500 pounds, is equivalent to 1,500 pounds.

62. Proof.—Subtraction may be proved, as in arithmetic, by adding the remainder to the subtrahend. The sum ought to be equal to the minuend, upon the obvious principle, that the difference of two quantities added to one of them, is equal to the other.

EXAMPLES.—(1.) From 2xy — 1, subtract —xy + 7.

Operation. Here, Minuend 2xy — 1 Subtrahend —xy + 7

Remainder 3xy — 8

(2.) From h + 3bx (3.) hy — ah (4.) nd — 7by

Take 3h — 9bx 5hy — 6ah 5nd — by

Answer —2h + 12bx —4hy + 5ah —4nd — 6by

(5.) (6.) (7.) (8.)

3abm — xy —17 + 4ax ax + 7b 3ah + axy

7abm + 6xy —20 — ax —4ax + 15b —7ah + axy

10abm — 7xy + 3 + 5ax + 5ax — 8b + 10ah

63. When there are several terms alike in the subtrahend, they may be united and their sum be used. Thus,

EXAMPLES.—(1.) From ab, subtract 3am + am + 7am + 2am + 6am.

Here ab — 3am — am — 7am — 2am — 6am = ab — 19am.

(2.) From y, subtract a + a + a + a. Ans. y — 4a.

(3.) From ax — bc + 3ax + 7bc, subtract 4bc — 2ax + bc + 4ax.

Answer. 2ax + bc.

(4.) From ad + 3dc — bx, subtract 3ad + 7bx — dc + ad.

Answer. 4dc — 8bx — 3ad.

64. The sign —, placed before the marks of parenthesis which include a number of quantities, requires that, when these marks are removed, the signs of all the quantities thus included should be changed. Thus a — (b — c + d) signifies that the quantities b — c and + d are to be subtracted from a. Remove the parenthesis, and the expression will then become a — b + c — d. An expression which has exactly the same meaning as the former.

EXAMPLE.—From xy + d, take 7ad — xy + d + hm. Here, xy + d — (7ad — xy + d + hm) = —7ad + 2xy — hm. Answer.

65. On the other hand, when a number of quantities are to be introduced within the marks of parenthesis, with — immediately preceding it, their signs must be changed. Thus, —m + b — dx + 3h = —(m — b + dx — 3h).

EXERCISE 5.

1. From 6ab + 7xy + 18dy, take 3xy + 4ab + 8dy.

2. From —35ax — 21ab — 37m, take —30m — 15ab — 10ax.

3. From 9ay + 19bx + 22bc, take 12ay + 31bc + 50bx.

4. From 8xy — 10ab + 6d, take —12ab + 10d + 24xy.

5. From 7a + 6x + df + xyz, take 3x — 4a — 3df — 17xyz.

6. From 18bc — xy + 22gh, take 41xy — gh + bc.

7. From 21ax + y + ac — ay, take 4a — bc + x — yz — dc.

8. From 21x + 40xy — 13a, take 42 + 10ab — 5bc.

9. From 5xy, take 2ab + 30ab + ab — 4ab.

10. From 5ax + 16ay, take 4ax — ay + 3ax + 4ay.

11. From a + b, take —(c + d — f + g — h — xy).

12. From 7ab + 16cy — 7ad, take —(6ab — 12xy + ad).

13. Introduce the following quantities within a parenthesis with — immediately preceding, without altering their value; viz., —a + b — c — d + f + gh.

14. Also, ab — cdx + 2ef — x — y + ghf — bc + xyz.

15. From 4xz + 6lbb, take 3xz + 4lbb.

16. From 20yy — 2y + 12aaz, take 15yy — 2y — 12aaz.

17. From —8(a + b) + 10(x + y), take 2(a + b) — 6(x + y).

18. From 4(a + b) — 16(x + y), take 17(a + b) + 36(x + y).

19. From 2a — aa + ba, take a — 4aa — 6ba.

20. From ax + 3x — xax, take 2x + 3x + 10ax.

21. From 13 — 25ab + 20x + 3y, take 3x + 3y — 25ab + 1.

22. From 6(a — y) — 17(x + y), take 3(a + y) — 7(a — y).

23. From ax — xy — my — 6, take 6ax — 6xy — ay + 46 — 7df.

24. From 66a — 4b, take 20a — b — 39a — 16a — 3b + 5a.

25. From 6x² — a⁶, take 2x² — b⁶.

26. From x⁴ + 4x²y + 6x²y² + 4xy³ + y⁴, take x⁴ — 4x²y + 6x²y² — 4xy³ + y⁴.

27. From 4a³ — 8a⁴ + 16a⁵, take 3a³ — 4a⁴ + 5a⁵.

28. From a + b + c, take —a + b + c.

29. From 4a² — 3a²x + ax² — 2x³, take 2a² — 4a²x — ax² — x³.

30. Take x² — 3x² + 3x — 1 from x³ + 3x² + 3x + 1.

31. From ax² + by², take ax² — dy².

KEY TO EXERCISES IN LESSONS IN ALGEBRA.

EXERCISE 4.

1. 6ab + cd — 4m + 7.
2. 3y — dx + hm — 1.
3. abm + bm — 5y + x + 16.
4. 8em + 3xy — 11.
5. 9ahy + 16.
6. 11ad + xy.
7. by + 3(b — a)x + 3a.
8. 6ax + 4xy.
9. 6b + 4cdy — 3xy.
10. 18a + 4ax — 5bx + 63cx + 3z — 17xy.
11. 8ab — 6bc + 4cd — 7xy + 17mn + 18fg — 2ax.
12. 8abc + 25abd + 5xyz.
13. 3df + 4ax + 74y + 30.
14. 55a + 68b.
15. 7(a + b).
16. 2xy(a + b).
17. 2ax + 5aa + 3x + 3xxx.

HISTORIC SKETCHES.—XXIX.

SUMMARY OF SKETCHES FROM ENGLISH HISTORY.

It is proposed in the present paper not to draw a fresh sketch of any historic incident, but to present a summary of what sketches have been given already, to re-survey the ground over which we have travelled, and to point out the chief features of English history which have been deemed noteworthy.

In our first sketch (Vol. I., page 9) we gave some account of the early history of our island from the day when the Romans landed in 55 B.C. until the death of Harold in 1066; and we endeavoured to present a picture of Anglo-Saxon England under the Heptarchy and under one supreme monarch. In doing this we were, of course, led to glance at the ever-recurring strife between the Saxons and the Danes, and at the introduction of Christianity into the country through the agency of Augustine.

In the three following sketches we narrated the events immediately succeeding the Norman Conquest, showing how for eighty years—from A.D. 1066 to 1146—the country periodically rang with the cry of "Down with the Normans." The Saxons, Danes, and Celtic Britons, the victims of cruel oppression, and frenzied with despair, repeatedly rose against their Norman conquerors, but all in vain. Revolt after revolt was put down by a stern hand, the last outbreak occurring in 1137. After this time we gradually lose all traces of distinctness between the inhabitants of the country. "Inter-marriages, community of interest, the exigencies of domestic and foreign policy, all contributed to blend the antagonistic races into one. By the time that Simon de Montfort sent out his writs in 1264 for the first English Parliament to assemble, we find no invidious distinction between English and Normans, and we mark no longer, excepting in the names of members of the Upper House, the deeply carved furrows of the Norman Conquest."

And now, arriving at the date of the first memorable event in the history of free England, we showed in our fifth sketch how the chief bulwark of English freedom, the Great Charter, was won. The miserable condition of the working classes, both artisans and labourers, was set forth, and it was shown how that the clergy of the day, with Stephen Langton, Archbishop of Canterbury, at their head, had compassion upon them and strove to help them to some measure of liberty. How the result of their action fell short of what was intended was also shown, but the fruits of their striving were duly noted and commended as being very great. In the days of King John (1199—1215), the clergy were the friends of liberty, and ever sought to make free, in every

sense of the word, those who were committed to their spiritual care. Stephen Langton had the address to gather up into his hand, and to direct the force of the men of the sword, the men who alone were capable of forcing concessions from the king, and he used his power to obtain for all free men privileges which hitherto had existed, if at all, by sufferance. Magna Charta provided protection for the persons and property of all free men, and established the right of free men to be exempt from all taxation which had not originated with, or been agreed to by themselves. It also provided for a Court of Common Pleas, wherein all suits of a civil nature between subject and subject were heard and determined; it forbade the infliction of ruinous fines for misdemeanours, and it laid the foundation of that fabric of political and social freedom which the exertions and wisdom of succeeding generations have reared in England. One thing, however, it failed to do. It did not give the people, not even the recognised freemen, admission or representation at the National Council, neither did it guard laymen against the tyranny of churchmen, nor make the churchmen give any security for their good behaviour. For this second matter, Henry II., some years previously, had tried to assert once and for ever the supremacy of the State over the Church; but by the wicked blunder of the murder of Thomas à Becket his purpose was thwarted.

The omission of the framers of the Great Charter to procure representative authority for the people was probably intentional; the barons and great tenants of the crown could not brook the notion of any but their peers being associated with them in council. But half a century later, in 1265, it was found impossible to exclude any longer from some political status those who contributed so largely to the burdens of the country. Simon de Montfort, Earl of Leicester, acting on behalf of liberty and of the English people, summoned in his king's name the first Parliament, in which counties and the large towns were represented by delegates chosen by the freeholders; and though, under the circumstances stated in Sketch VI., it was subsequently attempted to repudiate the idea of representation, the ruling powers found it absolutely necessary, not only to recognise what had been done, but to systematise representation, and finally to erect into one of the permanent institutions of the land a House of Commons, acting in concert with, but independent of, the House of Lords.

In Sketch VII. was shown the effect of wilfully keeping the people in ignorance, and of a system of legislation by which even the nominally free labourers were reduced to a condition of slavery. The rising of the labourers in the reign of Richard II. was the natural outcome of the relation in which employer and employed had stood to one another since the Conquest; and though in its immediate result it fell far short of the good aimed at by the Commons, and even brought down upon the rebels a temporary aggravation of their lot, it gained for those most concerned the attention and goodwill of a section of the House of Commons, which was then daily increasing in power and importance. It showed, moreover, what strength there was in that great multitude known as the people, and wise statesmen laid the knowledge to heart, and utilised it later for the benefit of the masses and of the nation. They relied upon it, with success, for carrying out the grand idea first practised, if not originated, by Simon de Montfort, of governing the nation by the nation, and not by a minute section of it; they used it to back up their pretensions to make the House of Commons master in England, a position the House actually did occupy under the very king whose personal courage so much contributed to the overthrow of Wat Tyler and his followers; they used it in the succeeding ages, down to comparatively modern times, in order to build up and strengthen that fabric of constitutional liberty which has been the growth of many centuries, which has been the subject of many struggles, even of civil war, but which secures to those under it all the liberty possible in the freest republic, without imposing upon them the inconveniences which seem to be inseparable from that form of government.

Our next sketch is from a period which seems to be common to all nations whatever, a period of active bigotry and superstition, when those who had spiritual charge of Christ's children in the land deemed it to be their duty to eradicate all differences of opinion in religious matters by a free use of the

halter and fagots. The check which Henry II. tried to place on the clergy when he offered the Constitutions of Clarendon for their assent, was not only thrown utterly away, but the recoil of that famous piece of State artillery seemed only to make itself felt about the time the House of Lancaster came to the throne. A flaw in the title to the Crown the clergy agreed to wink at in consideration of recognition being accorded to them for all their claims; they procured the passing of the first Statute of Heresy, under which they burned and destroyed a great number of people, ostensibly with the object of saving their souls by the sacrifice of their bodies. The circumstances under which the first martyr for freedom of conscience—William Santré—suffered are depicted in the sketch bearing his name. He was the first of a long line of successors at the stake, some of them enthusiasts of the aggressive or demonstrative kind, some of them including among their number the gentlest and softest-hearted believers of their day. Though open persecution for conscience' sake virtually ceased with James I., the power to persecute was not taken away from the law till the reign of Charles II., when the infamous writ of *hæretico comburendo* was formally abolished.

In the two sketches of Sir Richard Grenville and Sir Walter Raleigh, the object was to portray, as far as might be done in so limited a space, the men of action who made England's arm felt in the cause of political and religious liberty all over the world during the reign of Queen Elizabeth. The spirit which actuated these men was of the old heroic kind. They willingly renounced a life of ease and pleasure, the sweet influences of home-life, the sunshine of the court, and the society of the most elegant and most brilliant men of the period, in order to pursue their ideal, the overthrow of the two incarnations, as it seemed to them, of royal and priestly despotism—Spain and the Roman Catholic religion. To this end they worked ever, Sir Richard Grenville representing the rougher and more uncompromising specimen of English doggedness of purpose; Sir Walter Raleigh representing in addition the refined man of learning, the elegant courtier, the thoughtful founder of colonies, the man of science, and the speculator. What such men achieved, how they worked, fought, lived and died, constitute a large portion of the history of Elizabeth's reign. Space failed to allow of mention of more than these two. Had it not done so, it would have been our pleasant task to declare the wisdom, the valour, the devotedness, and the success of those many other splendid ornaments of the Elizabethan age, when the danger of England, and incidentally of all Protestant Europe, was greater from the assaults of foreign and domestic foes than it ever was before or ever has been since. It was due, under God's providence, to the marvellous array of individual power, focussed, as it were, into a common space, of which the Queen was the centre, that England and her brethren on the Continent came out of the struggle with Spain and the Papacy stronger for the war. Nothing short of a great self-sacrifice, entire, perhaps even exaggerated loyalty, and a responsible apprehension of the greatness of the interests at stake, could have effected this; and such qualities were possessed by the typical men whose sketches we have tried to draw—Sir Richard Grenville, who died rather than surrender, at the Azores; and Sir Walter Raleigh, whom a master, all unworthy of so noble a subject, put to death in Palace Yard by way of peace-offering to the offended majesty of Spain.

Three of the next four sketches deal with the troublous era in English history known as that of the Great Rebellion. It was impossible not to take the sketches from several points of view, in order to give a better general idea of the whole subject. The three we have taken—"King Charles's Veto on Emigration," "Charles I., when the Commons cried 'Privilege!'" and "The Protector of the Commonwealth," are intended to give some idea of the state of England and of her politics at the great crises of her domestic sickness. In the first was shown the state of England when Charles I. began, with the advice of evil counsellors, that governmental system of "thorough," which had for its sole aim and object the elevation of the kingly power at the expense of all the constitutional powers that were equally valid with it. The almost blind way in which the king rushed headlong upon his fate is likewise foreshadowed; and in the second sketch of the three is shown both the height to which the idea of royalism had risen, and the temper in

which the English nation, then faithfully represented by its House of Commons, first expected and then resisted the encroachments which absolutism seemed disposed to make upon its liberties. All the constitutional means known to the people were tried in the hope of bringing the king to reason, and though the application of these was the occasion of some heat, it was supposed that an open rupture between King and Parliament might be avoided, until Charles himself opened the way to unconstitutionality by deserting London, which he declared to be unsafe for him to live in, and unfurling the royal standard at Nottingham, on which occasion he declared that the quarrel must be referred to the arbitrament of the sword, and set forward accordingly upon the path of blood.

The third sketch of the series shows the character and qualifications of the man who succeeded Charles in the government of the kingdom, and is intended to set forth both the good and evil of the Lord Protector's rule. That both were manifested there cannot be any doubt, and much of the evil was derived from the action rendered absolutely necessary by the exceptional state of things, by the demand for severe repressive measures in the presence of numerous and never-ending plots for the subversion of the Government, and by the need which the new Government had constantly to assert itself. In the sketch an attempt was made to show not only the character of the Protector's government, but the character of the Protector himself, the cares he suffered, the weight of responsibility he endured, and the depressing sense he entertained of the utter hopelessness of what he was doing. The manner of his death was also mentioned, and one side of a contrast was established to show how different was the political influence of England and her place among the nations during the time of the Commonwealth, and the time which immediately succeeded it.

Following the sketch entitled "King Charles's Veto on Emigration," came, in order of date, an account of "How England became possessed of India." Herein we told the story of the growth of the East India Company, bound up as it was with the achievements of Robert Clive and of Warren Hastings, the first Governor-General of India. How the powers of the Company were transferred to the Crown; how the Queen of England was proclaimed Sovereign of Great Britain and the Colonies (including India) in 1858, and Empress of India in 1876; how the Sepoy mutiny broke out and was quelled—all these things we have narrated at some length.

The restoration of the House of Stuart is said by some to have been allowed, in order to convince the nation of the utter impossibility of suffering its princes to sit upon the English throne. That Charles II. and his friends conducted themselves in a manner to forfeit the good opinion of all patriotic and right-minded men, and that this misconduct had its counterpart in every department of the State, are matters of general history; all that could be done here was to give one notable instance in which the Stuart influence permeated to and corrupted even the fountains of justice, and made the public tribunals a mockery and a byword. The story of the Bloody Assize was added to show the entire hopelessness of the Stuart régime, and to explain the reasons which in 1688 led the English legislature to declare that King James II. "had broken the original contract between king and people, and that the throne of Great Britain was vacant."

The very worst and most questionable incident in the life of William III.—the massacre of Glencoe—has been made the subject of a sketch in order that the man might appear as he really was, even under such unfavourable circumstances, a disinterested hero. The slur of the massacre has been cast upon the king, whose minister presumed upon his position to gratify private, local malice, and to do a large amount of veritable evil in the belief that good would result from it; but how little William himself had to do with the matter has been shown, we trust, in our sketch of the business. We have forbore to take, as we might easily have done, a sketch from parts of his life when he would have appeared solely as a beneficent man, who had renounced the first position in his own country, and the pleasures of independence, in order to do good as the leader of a country which looked to him as its only possible chief, but yet rewarded him for his devotion by deliberately stamping on all his most cherished plans, and thwarting all his private personal wishes.

In Sketches XVIII., XIX., XXVII., and XXVIII., it was shown when and by what means Ireland and Scotland became parts of the empire, the deliberate policy by which Edward I. was guided in his obstinate endeavours to subjugate Scotland, and the almost accidental circumstances under which the disunited chiefs in Ireland allowed their country to fall a prey to the rapacity and desperation of a few Anglo-Norman adventurers. An attempt was also made to do justice to the efforts of those who at various times endeavoured to win back independence for their respective countries, and it was detailed how the struggle, continued down to comparatively modern times, was ended by union, arranged on terms agreed to by both sides.

In Sketches XX. and XXI. (Vol. II., pages 218 and 253) are detailed the efforts made by the House of Stuart to re-enter into authority in the kingdom; there, too, is described the result of their last attempt to take the kingdom by violence, and the determination with which the bulk of the English nation declared for the House of Hanover and Protestant succession.

The disgraceful circumstances under which Admiral Byng was offered up as a sacrifice to appease the populace for the national disasters which came thick and fast during a portion of the reign of George II., are set forth in Sketch XXII. (Vol. II., page 285), while in Sketch XXIV. the origin of the United States is briefly narrated. The remaining three papers which conclude the series of Sketches from English History describe the Gordon riots, or the attempts which ignorant and misguided men made to overthrow the oppressive government of George III. in so far as it affected the working class; the dagger scene in the House of Commons, when Mr. Burke warned the House and the nation of the rock towards which the policy of Mr. Fox, which was the policy of the French Revolution, was guiding the vessel of the State; and the meaning of the interest which the people took in the case of the demagogue Wilkes, the man whom, as stated in the sketch, the Earl of Chatham appropriately described as "the blasphemer of his God, and the libeller of his king."

These sketches include subjects from the earliest period of English constitutional history, and those taken from periods immediately anterior to the great war of England and her allies with the apostles of the French Revolution. In succeeding articles we hope to present a few characteristic sketches showing some of the great incidents in ancient history and the life of Continental nations in modern times.

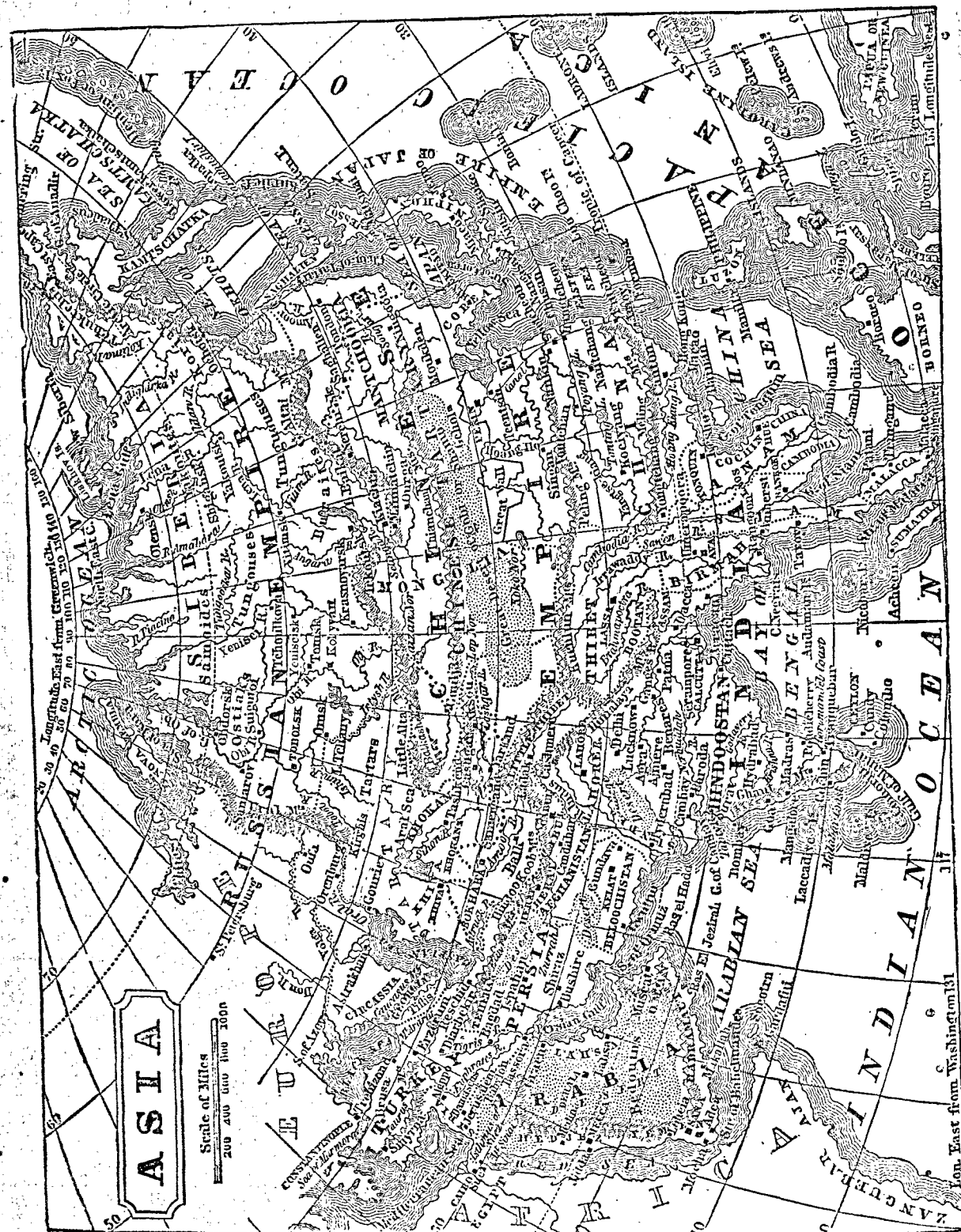
LESSONS IN GEOGRAPHY.—XXIX.

ASIA.

Position on the Earth's Surface.—Asia, the cradle of the human race, and the original seat of the Garden of Eden, lies within the northern and eastern hemispheres, and to the east and south-east of Europe. The greater part of this continent lies within the north temperate zone; the exceptions being part of Siberia, which lies within the north frigid zone, and parts of Arabia, Hindostan, Further India, and China, which lie within the torrid zone.

Boundaries.—Asia is bounded on the north by the Arctic Ocean; on the south by the Indian Ocean and the Chinese Sea; on the east by the Pacific Ocean; and on the west by the Ural Mountains, Ural River, Caspian Sea, Mount Caucasus, Black Sea, Sea of Marmora, the Mediterranean Sea, the Isthmus of Suez, which connects it with Africa, and the Red Sea or Arabian Gulf.

Extent, Length, Breadth, etc.—This continent extends from lat. 78° 25' N., to lat. 1° 20' S.; and from long. 26° 4' E., to long. 170° W. This shows that a very small portion of this continent lies in the western half of the northern hemisphere. Its length, from the Strait of Bab-el-Mandeb, at the entrance to the Red Sea, to Behring Strait, between Asia and North America, is about 7,000 miles, measured across the continent in a straight line, as the crow flies. Its breadth, from Cape Severo, also called Cape Tchelluskin, and North East Cape, in Siberia, in a straight line from north to south, almost identical with the 102nd meridian of east longitude, to Cape Romania, at the extremity of the Malay Peninsula, is about 5,250 miles. This continent is connected with that of Africa, at the Isthmus of Suez, which is about 80 miles wide. The surface of Asia, in-



cluding its islands, is reckoned by some to contain about 16,626,500 square miles, and its population to be about 712,000,000; if these approximations be somewhat near the truth, there will be, on an average, about 42 inhabitants to every square mile of this division of the world; but much of it contains vast deserts, destitute both of useful vegetation and human population. Thus, in Siberia, which is reckoned by some to contain about 5,500,000 square miles, the population, according to a recent estimate, was scarcely more than 4,000,000 inhabitants; which allows only four inhabitants to every 5½ square miles. On the other hand, China Proper contains about 1,700,000 square miles, while the population is about 370,000,000 inhabitants; and this estimate allows about 217 inhabitants to the square mile! The linear extent of the coast line of the continent of Asia is reckoned by some at 35,000 miles, while by others it is estimated at only 30,000 miles.

The seas and gulfs of Asia, on the west and the south, form an important feature of its natural divisions. The Red Sea and the Persian Gulf may be called inland seas. The Red Sea, so famous in sacred history, otherwise called the Arabian Gulf, with its two arms, the Gulf of Suez and the Gulf of Akabah, over the former of which the Israelites crossed on dry ground, is about 1,500 miles long, its breadth varying from 100 to 200 miles, except in the gulfs at its northern extremity, and its surface being about 200,000 square miles. The two arms above mentioned are so called from the names of the towns at their northern extremities; these arms inclose between them the desert region called the peninsula of Sinai, in which the forty years' wanderings of the tribes of Israel were performed—fit emblem of the wanderings of human life in this lower world. The entrance to the Red Sea is by the Strait of Bab-el-Mandeb, about seventeen miles wide. This sea opens out at this strait, through the Gulf of Aden, into the Arabian Sea, which washes the western shores of India, the southern shores of Arabia, and terminates in the entrance to the Persian Gulf, at the Strait of Ormuz, through the Gulf or Sea of Oman. The Persian Gulf contains about 95,000 square miles. The Bay of Bengal, whose waters wash the eastern shores of Hindostan or India, and the western shores of the peninsula of Further India, is an arm of the Indian Ocean. The part of this bay which washes the shores of the British province of Pegu, in Further India, is called the Gulf of Martaban. To the east of the Indian Ocean lies the Oriental Archipelago, studded with the East India Islands. To the north of this lies the Chinese Sea, with the gulfs of Siam and Tonquin.

The channel between the Malay Peninsula and the Island of Sumatra is called the Strait of Malacca. Between the islands of Sumatra and Java is the Strait of Sunda, these islands being called the Sunda Isles. From the Chinese Sea to the Tong Hai, or Eastern Sea, the passage is through the Strait of Formosa; north of the last-named sea lies the Yellow Sea, whose waters wash the eastern shores of China Proper; the north-west part of the Yellow Sea being called the Gulf of Po-che-lee, and the northern part the Gulf of Leao-tong. Between the peninsula of Corea and the islands of Japan lies the Sea of Japan, the north part of which is called the Gulf of Tartary. North of this gulf lies the Sea of Okhotsk, or Kurile Sea, which washes the western shores of the peninsula of Kamtschatka. On the other side of this peninsula is the Sea of Kamtschatka, or Behring Sea, bounded on the south by the Aleutian Isles. All these seas and gulfs, from the Strait of Malacca to Behring Strait, between Asia and America, are branches or arms of the North Pacific Ocean. Behring Strait, which is reckoned by some writers to be only 52 miles broad at the narrowest part, separates the Arctic Ocean from the Pacific. In the former, there are some gulfs which run into the northern parts of Siberia, namely, the Kara Gulf or Sea, with its arms, the Gulfs of Obi and Yeniseisk.

The islands which lie around Asia are of the highest importance both to that continent and to the continent of Europe, to which they principally belong, as colonial possessions in the east of European nations. But, although we mention these islands at the present time, in consequence of their proximity to the mainland of the Asiatic continent, it must be remembered that, with a few exceptions, the islands that we are about to name are included in the division of the earth named Oceania. The islands that strictly belong to Asia are named in the summary of islands at the end of this lesson.

The East Indies, otherwise called the islands of the Oriental, Eastern, or Asiatic Archipelago, have been long famous for their produce; and situated under the line of the equator, or within the torrid zone, they yield such as cannot be found in more temperate climes. The Sunda Isles, with Sumatra and Java, with others, lie to the south of the peninsula of Further India (which, with Hindostan, is often included under the general name of the East Indies); the length of Sumatra is about 1,100 miles, and its breadth about 160 miles—it contains a surface of about 130,000 square miles; the length of Java is about 600 miles, and its breadth 100 miles—it contains a surface of about 52,000 square miles. The island of Borneo, which lies to the east of Sumatra, and to the north of Java, is about 850 miles long, and about 700 miles broad, and contains about 300,000 square miles. This island is the largest island in the world. The island of Celebes is about 500 miles long, and about 150 miles broad, and contains about 72,000 square miles.

The equator crosses each of these three islands nearly at the middle of each. Next follow the Molucca Islands, called, from their products, the Spice Islands, including Amboyna, 32 miles long, by 12 miles broad, and containing about 282 square miles; then the Philippine Islands, north of these, including Luzon and Mindanao; the former about 400 miles long, and about 100 miles broad, with a surface of about 56,000 square miles; and the latter about 300 miles long, and about 108 miles broad. North of the Philippines is the island of Formosa, belonging to China; and the Loo-choo Islands, north-east of Formosa, subject to China. North and north-east of these islands are the Japan Islands, of which the largest is Nippon, about 800 miles long, and 100 broad; the next, Jesso, or Yesso, about 280 miles long, and 200 miles broad; next, Kinsiu, about 150 miles long, and 120 miles broad; and the next Sikoke, about 90 miles long, and 50 broad. These islands include a surface of about 265,000 square miles, and form an important appendage to the continent of Asia. The other islands on the west of Asia, and in the North Pacific Ocean, are of small size and importance. In the northern ocean there are a few islands, of which very little is known. South of India are the Andaman and Nicobar Isles, in the Bay of Bengal, and the important island of Ceylon, south-east of the peninsula of Hindostan, with an area of about 23,500 square miles, and a population of about 1,500,000—a fine appanage of the British crown; it is separated from the peninsula of India by the Gulf of Manar, and the strait called Palk Strait. On the other side of Cape Comorin, the most southern point of India, lie the Laccadive and Maldivé Islands, south-west of the Malabar coast.

SUMMARY OF BOUNDARIES.

NORTH.—The Arctic Ocean.
SOUTH.—The Indian Ocean and Chinese Sea.
EAST.—The Pacific Ocean.
WEST.—Ural Mountains, Ural River, Caspian Sea, Caucasus Mountains, Black Sea, Sea of Marmora, Mediterranean Sea, Isthmus of Suez, and the Red Sea.

SUMMARY OF PRINCIPAL SEAS AND GULFS.

Black Sea, N. of Turkey. [Minor.
Sea of Marmora, N.W. of Asia
Egean Sea or Archipelago, W. of Asia Minor.
Levant, W. of Syria.
Red Sea, W. of Arabia.
Gulf of Aden, S. of Arabia.
Persian Gulf, E. of Arabia.
Gulf of Oman, S. of Beloochistan.
Arabian Sea, S.W. of India, or Hindostan.
Gulf of Munnar, E. of Ceylon.
Indian Ocean, S. of India.
Bay of Bengal, S.E. of India.
Gulf of Martaban, S. of Pegu.
Chinese Sea, S. of China.
Gulf of Siam, S. of Further India.
Gulf of Tonquin, E. of Further India.
Yellow Sea, E. of China.

Sea of Japan, W. of Japan.
Sea of Okhotsk, S. of Siberia.
Sea of Kamtschatka, E. of Siberia.
Behring Sea, N.E. of Asia.
Kara Sea, or Gulf of Kara, N.W. of Siberia.
Gulf of Obi, N.W. of Siberia.
Gulf of Yeniseisk, N.W. of Siberia.

STRAITS.

Bab-el-Mandeb, S. of Red Sea.
Ormuz, E. of Persian Gulf.
Palk Strait, N. of Ceylon.
Strait of Malacca, W. of Malaya.
Sunda Strait, S.E. of Sumatra.
Behring Strait, E. of Siberia.

ISLANDS.

Rhodes, Scio, Mitylene, in the Archipelago.
Cyprus, in the Levant.
Laccadives, W. of Hindostan.
Maldives, S. of Laccadives.
Ceylon, S. of Hindostan.
Andaman Islands, Bay of Bengal.
Nicobar Islands, S. of Andaman Islands.
Hainan, S. of China.
Formosa, E. of China.
Loo-choo, N.E. of Formosa.
Japan Isles, E. of Corea.
Kurile Islands, N. of Japan.
Saghalien, Sea of Okhotsk.
New Siberia, or the Likhov Islands, Arctic Ocean.

LESSONS IN LATIN.—XXIX.

THE FOUR CONJUGATIONS.

SOME verbs of the third conjugation seem to partake of qualities of the verbs of the fourth. In the present tense the stem with the parts formed from it is strengthened by the vowel *i*, and so partly corresponds to the forms of the fourth conjugation. The *i*, however, disappears before a consonant. I give a specimen in *capio*, 3, *I take*.

ACTIVE VOICE.

PRESENT TENSE.

Indicative.	Subjunctive.	Imperative.	Infinitive.	Participle.
Sing. <i>Capio.</i>	<i>Capiam.</i>	<i>Capere.</i>	<i>Capere.</i>	<i>Capiens.</i>
Capis.	<i>Capias.</i>	<i>Capite.</i>		
Capit.	<i>Capiat.</i>	<i>Capite.</i>		
Plu. <i>Capimus.</i>	<i>Capiamus.</i>	<i>Capite.</i>		
<i>Capitis.</i>	<i>Capiat.</i>	<i>Capite.</i>		
<i>Capiant.</i>	<i>Capiant.</i>	<i>Capite.</i>		

IMPERFECT TENSE.

Sing. <i>Capiebam.</i>	<i>Caperem.</i>
etc.	etc.

FIRST FUTURE TENSE.

Sing. <i>Capiam.</i>	<i>Capies.</i>
etc.	etc.

PASSIVE VOICE.

PRESENT TENSE.

Indicative.	Subjunctive.	Imperative.	Infinitive.	Participle.
Sing. <i>Capior.</i>	<i>Capiar.</i>	<i>Capere.</i>	<i>Capere.</i>	<i>Capiens.</i>
<i>Capis.</i>	<i>Capias.</i>	<i>Capite.</i>		
<i>Capitur.</i>	<i>Capiat.</i>	<i>Capite.</i>		
Plu. <i>Capimur.</i>	<i>Capiamur.</i>	<i>Capite.</i>		
<i>Capimini.</i>	<i>Capiamini.</i>	<i>Capite.</i>		
<i>Capimur.</i>	<i>Capiamur.</i>	<i>Capite.</i>		

IMPERFECT TENSE.

Sing. <i>Capiebar.</i>	<i>Caperer.</i>
etc.	etc.

FIRST FUTURE TENSE.

Sing. <i>Capiar.</i>	<i>Capies.</i>
etc.	etc.

Thus conjugate *cupio*, 3, *I wish, desire*; *facio*, 3, *I do, make*; *fodio*, 3, *I dig*; *jacio*, 3, *I throw*; *pario*, 3, *I bring forth*; *rapio*, 3, *I plunder*; *sapio*, 3, *I taste*, etc.; *dico*, 3, *I say*; *duco*, 3, *I lead*; *facio*, *I do or make*; *fero*, 3, *I bear*. The 2nd person singular of the imperatives of the last four verbs are respectively *dic, duc, fac, fer*.

Let it be again remarked that the participles in *-us* are declined like adjectives in *-us*, thus:—

<i>Amatus, -a, -um.</i>	<i>Docturus, -a, -um.</i>
<i>Amati, -ae, -i.</i>	<i>Docturi, -ae, -i.</i>
<i>Amato, -ae, -o.</i>	<i>Docturo, -ae, -o.</i>
<i>Amatum, -am, -um, etc.</i>	<i>Docturum, -am, -um, etc.</i>

In all instances they must agree with their nouns. So also must the infinitive passive of the past tense, as *crudifum esse*, *eruditum esse*; *eruditus esse*, *they have been instructed*, the participle changing as the noun changes.

The participle future in *-urus* is frequently used after a verb denoting motion, to point out the object or design; as, *veniunt expugnaturi urbem*, *they come with a view to capture the city*.

Besides the conjugations now set forth, there is another recognised by grammarians. This is called the Periphrastic Conjugation. It is called periphrastic (Greek, *περι*, *per-i*, *about*; and *φρασις*, *phra-sis*, *a speech*), because it is a kind of circumlocution; the changes of idea not being expressed by additions to the stem, as in the ordinary conjugations, but by two separate words. Thus such a conjugation or form is made by the participles and the several tenses of the verb *esse*, *to be*; for example—

<i>Amans, amaturus, amatus, amandus.</i>
<i>Sum, eram, ero, fui, fueram, fuero.</i>

I supply the meanings of these forms:—

Amans sum, *I am loving*; the action proceeding and incomplete. *Amaturus sum*, *I am about to love*; an intended and immediately future action.

Amatus sum, *I have been loved*; completed action, passive voice. *Amandus sum*, *I ought to be loved*; action denoting necessity in time to come.

I have here limited myself to the present tense *sum*; changes of import are introduced by the other tenses of the verb, corresponding to the signification of those tenses.

The neuter of the participle in *-us*, commonly, but incorrectly, termed the nominative of the gerund, has an impersonal

meaning; as, *legendum est*, *it is to be read*; that is, *reading must be done* by some one. The subject of the action is indicated by pronouns in the dative case; thus:—

<i>Mihi amandum est</i> , <i>I must love.</i>
<i>Tibi amandum est</i> , <i>thou must love.</i>
<i>Ei amandum est</i> , <i>he must love.</i>
<i>Nobis amandum est</i> , <i>we must love.</i>
<i>Vobis amandum est</i> , <i>you must love.</i>
<i>Illis amandum est</i> , <i>they must love.</i>

The participle present has often a causal force, or assigns the reason of the action expressed in the sentence. It must sometimes be rendered into English as if it were a verb in the indicative mood; and sometimes as if it were an infinitive. Use only can make these peculiarities quite clear and easy.

The participle present and the participle perfect passive are used with a noun in the ablative case, forming what is called "the ablative absolute" (*ab* and *solutus*, *disconnected*, *independent*; that is, in construction).

Observe that the Romans employed the second person singular when they spoke of or to a single person. Consequently, you must translate *you* as if it were *thou*, in the English-Latin exercises, except when more persons than one are obviously intended.

VOCABULARY.

<i>Angustia, -arum</i> , 1, <i>a narrow way, narrow limits.</i>	<i>Exprobro</i> , 1, <i>I reproach with.</i>	<i>Publici juris factus</i> , <i>est</i> , <i>was established.</i>
<i>Appropinquo</i> , 1, <i>I approach.</i>	<i>Non supplicanti</i> , <i>without his entreating it.</i>	<i>Recupero</i> , 1, <i>I regain.</i>
<i>De, of, from, over.</i>	<i>Orbis terrarum</i> , <i>the world.</i>	<i>Reporto</i> , 1, <i>I carry off, obtain.</i>
<i>Detrimentum</i> , -i, <i>n.</i> , <i>injury.</i>	<i>Pectus, -oris</i> , <i>n.</i> , <i>the breast (E. R. pectoral).</i>	<i>Res-publica</i> , <i>rei-publicae</i> , <i>the state (a compound word, of which both parts are declined).</i>
<i>Ex, out of, after.</i>	<i>Persona, -ae</i> , <i>f.</i> , <i>a mask, a character.</i>	<i>Teter, -ra, -rum</i> , <i>foul, vile.</i>
<i>Ex labore sudanti</i> , <i>to one sweating from the effect of labour.</i>	<i>Potio, -onis</i> , <i>f.</i> , <i>drinking or draught.</i>	
<i>Lenio</i> , 4, <i>I soothe.</i>		

EXERCISE 104.—LATIN-ENGLISH.

1. Amici mei una domo capi non possunt. 2. Dic nobis qua consolatione eger amici animus lenitus sit. 3. Non capiunt angustia pectoris tui tantam personam. 4. Nec te orbis terrarum capiet. 5. Capientis est mihi cibus. 6. Tibi docendum est. 7. Docetis pueros, valde amabitis. 8. Dic cur puer punitus sit. 9. Bellum cepit finem. 10. Vide ne quid detrimenti res publica capiat. 11. Dic mihi quid tibi a sorore scriptum sit. 12. Nullum vitium tetricius est quam avaritia, praesertim in principibus republicae gerentibus. 13. Cogitantes caelestia, haec nostra ut exigua contemnimus. 14. Odiosum est genus hominum officia exprobrantium. 15. Ex labore sudanti frigida aquae potio est pernicio. 16. Vir bonus viro bono non supplicanti succurrit. 17. Cicero in alienas terras migraturus in unum locum congregatur. 18. Ingens hominum multitudo in urbem congregatur, ludos publicos spectatura. 19. Omnes dolores, patienter tolerati, minus acerbi sunt. 20. Dux dimittit milites ob eximiam virtutem laudatos. 21. Multi juvenes in prima pueritia a parentibus male educati, in perniciem ruunt. 22. Regnante Xerxe (abl. abs.), Graeci de Persia splendidissimam victoriam reportaverunt. 23. Inter bonos viros et Deum amicitia est, conciliante natura (abl. abs.). 24. Appropinquante hieme, multae aves mitiores regiones petunt. 25. Recuperata pace, artes efflorescunt. 26. Regibus exterminatis, Romani liberam rempublicam fundaverunt. 27. Terra mutata, mores hominum non mutantur. 28. Legibus divinis sancto observatis, vita nostra beata erit.

EXERCISE 105.—ENGLISH-LATIN.

1. True friends can be received in a small house. 2. The narrow limits of this house will not receive so great a character. 3. Tell me what your father has said to you. 4. Bear the water to thy mother. 5. Avarice in parents who govern their houses is a great evil. 6. Avarice blotted out, evil is blotted out. 7. Thinking of his native country, the soldier lost his life. 8. To one who is in fear (fearing), a friend is a great solace. 9. The state being disturbed, who can be happy? 10. A large multitude of men have come to drink wine. 11. The soldiers being praised, were disarmed. 12. In the reign of Victoria (Victoria reigning, abl. abs.), the Popular Educator (Educator Popularis) was established. 13. The book being changed, you do not change your thoughts.

DEPONENT VERBS.

I have already explained to you the meaning of the term *deponent* in the phrase *Deponent Verbs*. Deponent verbs are passive in form, but active in signification. I have already informed you that there are deponent verbs in each of the four conjugations. Under the guidance of this information you

might possibly find your course sufficiently plain. But I know that learners often have a good deal of difficulty with these deponent verbs, and I shall therefore go into some detail in connection with them.

Remember, then, that deponent verbs with a passive form have an active meaning. Take care that in construing you are not misled by the form. Take care not to confound passive verbs with deponent verbs. The exercises you are about to go through will assist you in these precautions, if you perform them carefully.

Taking the conjugations in the order in which they stand in the preceding exercises, I begin with *hortor*, *I encourage*, of the first conjugation. Now before you go over the parts of the verb observe the meanings carefully, as presented in the following paradigm or example. Particularly notice that *hortatus sum* means *I have encouraged*; and *hortatus, having encouraged*. These deponent verbs have properly no participles with a passive signification; accordingly, *hortans* is *encouraging*; *hortaturus*, *on the point of encouraging*; and *hortatus, having* (not being) *encouraged*.

DEPONENT VERBS.—FIRST CONJUGATION.

EXAMPLE.—*Hortor*, *I encourage*.

Indicative.	Subjunctive.	Imperative.	Infinitive.	Participle.
Sing. <i>Hortor</i> , <i>I encourage</i> , etc.	<i>Horter</i> , <i>I may encourage</i> , etc.	<i>Hortare</i> , <i>hortor</i> , <i>encourage</i> , etc.	<i>Hortari</i> , <i>to encourage</i> .	<i>Hortans</i> , <i>encouraging</i> .
<i>Hortaris.</i>	<i>Horteris.</i>	<i>Hortare</i> , <i>hortor</i> , <i>encourage</i> , etc.		

Plu. <i>Hortatur.</i>	<i>Hortetur.</i>	<i>Hortator.</i>
<i>Hortamur.</i>	<i>Hortemur.</i>	
<i>Hortamini.</i>	<i>Hortemini.</i>	<i>Hortamini.</i>
<i>Hortantur.</i>	<i>Hortentur.</i>	<i>Hortantur.</i>

Indicative.	Subjunctive.	Imperative.	Infinitive.	Participle.
Sing. <i>Hortabor</i> , <i>I shall encourage</i> , etc.	<i>Hortar</i> , <i>I may encourage</i> , etc.	<i>Hortare</i> , <i>hortor</i> , <i>encourage</i> , etc.	<i>Hortari</i> , <i>to encourage</i> .	<i>Hortans</i> , <i>encouraging</i> .
<i>Hortaberis.</i>	<i>Hortar</i> , <i>I may encourage</i> , etc.	<i>Hortare</i> , <i>hortor</i> , <i>encourage</i> , etc.		
Plu. <i>Hortabimur.</i>	<i>Hortemur.</i>	<i>Hortamur.</i>		
<i>Hortabimini.</i>	<i>Hortemini.</i>	<i>Hortamini.</i>		
<i>Hortabuntur.</i>	<i>Hortentur.</i>	<i>Hortantur.</i>		

Indicative.	Subjunctive.	Imperative.	Infinitive.	Participle.
Sing. <i>Hortatus sum</i> , <i>I have encouraged</i> , etc.	<i>Hortatus sim</i> , <i>I may have encouraged</i> , etc.	<i>Hortare</i> , <i>hortor</i> , <i>encourage</i> , etc.	<i>Hortari</i> , <i>to encourage</i> .	<i>Hortans</i> , <i>encouraging</i> .
<i>Hortaberis.</i>	<i>Hortar</i> , <i>I may encourage</i> , etc.	<i>Hortare</i> , <i>hortor</i> , <i>encourage</i> , etc.		
Plu. <i>Hortabimur.</i>	<i>Hortemur.</i>	<i>Hortamur.</i>		
<i>Hortabimini.</i>	<i>Hortemini.</i>	<i>Hortamini.</i>		
<i>Hortabuntur.</i>	<i>Hortentur.</i>	<i>Hortantur.</i>		

Indicative.	Subjunctive.	Imperative.	Infinitive.	Participle.
Sing. <i>Hortatus es</i> , <i>thou hast encouraged</i> , etc.	<i>Hortatus sis</i> , <i>thou mayst have encouraged</i> , etc.	<i>Hortare</i> , <i>hortor</i> , <i>encourage</i> , etc.	<i>Hortari</i> , <i>to encourage</i> .	<i>Hortans</i> , <i>encouraging</i> .
<i>Hortaberis.</i>	<i>Hortar</i> , <i>I may encourage</i> , etc.	<i>Hortare</i> , <i>hortor</i> , <i>encourage</i> , etc.		
Plu. <i>Hortabimur.</i>	<i>Hortemur.</i>	<i>Hortamur.</i>		
<i>Hortabimini.</i>	<i>Hortemini.</i>	<i>Hortamini.</i>		
<i>Hortabuntur.</i>	<i>Hortentur.</i>	<i>Hortantur.</i>		

Indicative.	Subjunctive.	Imperative.	Infinitive.	Participle.
Sing. <i>Hortatus es</i> , <i>thou hast encouraged</i> , etc.	<i>Hortatus sis</i> , <i>thou mayst have encouraged</i> , etc.	<i>Hortare</i> , <i>hortor</i> , <i>encourage</i> , etc.	<i>Hortari</i> , <i>to encourage</i> .	<i>Hortans</i> , <i>encouraging</i> .
<i>Hortaberis.</i>	<i>Hortar</i> , <i>I may encourage</i> , etc.	<i>Hortare</i> , <i>hortor</i> , <i>encourage</i> , etc.		
Plu. <i>Hortabimur.</i>	<i>Hortemur.</i>	<i>Hortamur.</i>		
<i>Hortabimini.</i>	<i>Hortemini.</i>	<i>Hortamini.</i>		
<i>Hortabuntur.</i>	<i>Hortentur.</i>	<i>Hortantur.</i>		

Indicative.	Subjunctive.	Imperative.	Infinitive.	Participle.
Sing. <i>Hortatus es</i> , <i>thou hast encouraged</i> , etc.	<i>Hortatus sis</i> , <i>thou mayst have encouraged</i> , etc.	<i>Hortare</i> , <i>hortor</i> , <i>encourage</i> , etc.	<i>Hortari</i> , <i>to encourage</i> .	<i>Hortans</i> , <i>encouraging</i> .
<i>Hortaberis.</i>	<i>Hortar</i> , <i>I may encourage</i> , etc.	<i>Hortare</i> , <i>hortor</i> , <i>encourage</i> , etc.		
Plu. <i>Hortabimur.</i>	<i>Hortemur.</i>	<i>Hortamur.</i>		
<i>Hortabimini.</i>	<i>Hortemini.</i>	<i>Hortamini.</i>		
<i>Hortabuntur.</i>	<i>Hortentur.</i>	<i>Hortantur.</i>		

GERUNDS.

<i>Gen. Hortandi</i> , <i>of encouraging.</i>
<i>Dat. Hortando</i> , <i>to encouraging.</i>
<i>Acc. Hortandum</i> , <i>to encourage.</i>
<i>Ab. Hortando</i> , <i>by encouraging.</i>

SUPINES.

1. <i>Hortatum</i> , <i>to encourage.</i>
2. <i>Hortatu</i> , <i>to be encouraged.</i>

After this manner, form (write in full, putting the English to every single part) *arbitror*, 1, *I am of opinion*, *I account*; *imitor*, 1, *I imitate*; *comitor*, 1, *I accompany*; *aspernor*, 1, *I despise*; *dominor*, 1, *I rule, sway*; *mercor*, 1, *I purchase*.

Let me remind you of the fact that the participles here, as in all other cases, undergo such changes as are necessary to put them in concord with their nouns in number, case, and gender; thus, *hortatus* in the singular becomes *hortati* in the plural; and *hortatus* in the masculine becomes for the feminine *hortata*, and for the neuter *hortatum*. So the infinitive *hortatum esse* may stand thus with a masculine noun in the accusative case, but with a feminine noun in that case it must become *hortatam esse*.

VOCABULARY.

<i>Admiror</i> , 1, <i>I admire.</i>	<i>Denum</i> , <i>adv.</i> , <i>then at length, then for the first time.</i>	<i>Propulso</i> , 1, <i>I drive away.</i>
<i>Contemplor</i> , 1, <i>I survey.</i>	<i>Pulchritudo</i> , <i>-inis</i> , <i>f.</i> , <i>beauty.</i>	<i>Somnium</i> , <i>-i</i> , <i>n.</i> , <i>a dream.</i>
<i>Conor</i> , 1, <i>I attempt.</i>	<i>Interpreto</i> , 1, <i>I give the meaning of (E. R. interpreter).</i>	
<i>Consigno</i> , 1, <i>I consign, record (lat. signum).</i>		

EXERCISE 106.—LATIN-ENGLISH.

1. Quis non admiretur splendorem, pulchritudinemque virtutis? 2. Dux milites hortatus est ut hostium aciem perturbare conarentur. 3. Jam hostes urbem oppugnare conati sunt, quum repente a civibus propulsi sunt. 4. Tum demum beatus eris quum aspernatus eris voluptatem. 5. Contemplamini praeclara virtutis exempla quae in historiis consignata sunt. 6. Venio te comitatum in hortum. 7. Somnia difficilia sunt interpretata. 8. Socrates totius mundi se incolas et civem arbitrabatur. 9. Disce libens. 10. Quid dulcius est quam discere multa? 11. Discentem comitantur opes, comitantur honores. 12. Homo improbus aliquando cum dolore flagitia sua recordabitur.

EXERCISE 107.—ENGLISH-LATIN.

1. I have admired the beauty of the women. 2. They encouraged the man. 3. The king will encourage his forces to drive away the enemy. 4. The father accounted the son wicked. 5. Who will interpret the signs? 6. Then, for the first time, wilt thou interpret the signs of God when thou art (shalt be) wise and good. 7. The examples of virtue are easily to be interpreted. 8. He was accompanying me in the garden when thou camest. 9. I go to accompany my father. 10. My father has come to accompany me into the province. 11. Honours will accompany the good and the wise. 12. Boys, learn being willing (willingly), and you will be admired.

KEY TO EXERCISES IN LESSONS IN LATIN.—XXVIII.

EXERCISE 98.—LATIN-ENGLISH.

1. My father takes care that I am strenuously cultivated. 2. I take care that the boy is well cultivated. 3. The father took care that the boy was well cultivated. 4. I take pains, that I may be loved by thee. 5. The conspiracy of Catiline was detected by Cicero. 6. Three most frightful wars have been carried on between the Romans and Carthaginians. 7. Labour and pleasure have been joined together by a certain natural relationship. 8. Many cities have been burnt by the enemies. 9. Scarcely had the enemies been beheld, when the soldiers were led out of the camp, in line of battle, by their general. 10. We feared that the city had been blockaded by the enemies. 11. Let God be religiously worshipped. 12. Let not the laws of God be despised. 13. Wise men always strive to be governed by reason. 14. Boys must be well cultivated. 15. Be not conquered by your desires. 16. You will not be rich unless riches (shall) have been despised by you. 17. Despising pleasures, you are loved. 18. So long as there is honour in learning, the Greek and Latin writers will be read in schools.

EXERCISE 99.—ENGLISH-LATIN.

1. Meus animus excoletur. 2. Fratris mei animus excultus est. 3. Si animus excultus erit tu diligetis. 4. Divitia ab sapientibus contemnuntur. 5. Divitia a me contemnuntur. 6. Divitia a patre contemptae erunt. 7. Divitia a te, mi fili, contemnuntur. 8. Ratione regi studeat. 9. Puer probe excolendus est. 10. Puer probe excolitur. 11. Curse mihi fuit ut voluptates a liberis meis contemnerentur. 12. Latini scriptores in schola mea leguntur. 13. Si bene vives, tu a bonis diligetis. 14. Metuo ut divitia a te contemnantur. 15. Multa bella ab Anglis gesta sunt. 16. Urbs ab hostibus combusta est.

EXERCISE 100.—LATIN-ENGLISH.

1. The soldiers hungered and thirsted during the whole day. 2. Nature has clothed the eyes with very thin membranes. 3. Why have you adorned and clothed the walls of your house with chaplets?

2. You had pleased your teachers, because you had always obeyed their commands. 5. Scarcely had our soldiers fortified the camp when Caesar formed a line of battle. 6. We shall not sleep until (before that) we have finished our business. 7. When the soldiers have fortified the camp, they will prepare for the fight. 8. Take care, boys, that you do not chatter. 9. The laws of the Spartans have this object, to instruct (that they may instruct) the youth in labours. 10. No one doubted that you had always taken care of the boys. 11. Tell me, by what consolation you have soothed the troubled mind of your friend. 12. I know not why you have punished the boy. 13. I did not doubt that you had kept my precepts in memory. 14. Do not chatter, daughters. 15. I come to ask you to walk (that you may walk) with me. 16. The soldiers ought to guard the city. 17. Wisdom is the art of seeing. 18. We must obey the precepts of virtue. 19. The art of sailing is most useful.

EXERCISE 101.—ENGLISH-LATIN.

1. Sitierant. 2. Esuriam. 3. Procepsis meis non obediens. 4. Pueri garriunt. 5. Patri non obediunt. 6. Nescio cur patri non obediunt. 7. Nemo dubitat quin boni pueri patri obediunt. 8. Verba mea memoria custodivit. 9. Cur mihi erit ut verba mea memoria custodiam. 10. Veniunt urbem munitum. 11. Ars scribendi utilis est. 12. Domus sum parietes coronis ornant. 13. Non prius dormiam quam negotia finivero. 14. Negotia finivimus. 15. Puerum puniebat, quam scholam intrabam.

EXERCISE 102.—LATIN-ENGLISH.

1. The father takes care that his son is well instructed. 2. The father took care that his son was well instructed. 3. The citizens fear that the camp is fortified by the enemies before the city. 4. The eyes have been clothed with very thin membranes. 5. When the king was entering the city, the houses of all the citizens were clothed and adorned with chaplets and flowers. 6. We shall not sleep until (before that) your business is (shall have been) finished. 7. As soon as the camp is (shall have been) fortified, the soldiers will prepare for the fight. 8. We feared that the city had been blockaded by the enemies. 9. Let the wicked be punished. 10. A good scholar strives to be instructed in the knowledge of letters. 11. The city, having been blockaded, is punished by many evils. 12. A cultivated man not only benefits himself but others also. 13. Boys must be diligently instructed.

EXERCISE 103.—ENGLISH-LATIN.

1. Custodiantur. 2. Urbs custoditur. 3. Urbs custodietur. 4. Urbs custodita est. 5. Curo ut urbs custodiat. 6. Nemo dubitat quin urbs bene custodiat. 7. Cives urbem custodire debent. 8. Cui cives non urbem custodiant? 9. Nescio cur cives non urbem custodiant. 10. Metuo ut cives urbem custodiant. 11. Ad pugnam se expedierunt. 12. Domus parietes floribus vestiti sunt.

MECHANICS.—IV.

FORCES APPLIED TO TWO POINTS—PARALLEL FORCES.

THREE cases of forces applied to two points present themselves for consideration. 1. When the lines of direction of the two forces meet *within* the body. 2. When they meet *without*. 3. When the two forces are parallel to each other.

First Case.—This is easily disposed of. When two forces meet *within* a body, the point of meeting may be taken as the point of application of both forces, which can there be compounded into one; and the case thus becomes that of a single force applied to a single point.

Second Case.—Here also the two forces may be reduced to one; but as their directions meet outside the body, it is necessary to show that their effect is the same as though the point of meeting was a *real* point of application. This, in a future lesson, can be demonstrated by a perfect proof; but, in the meantime, the following considerations will satisfy you that it is true.

Let A and B be the two forces applied to the points A and B (as in Fig. 10), and O the outside point in which their directions meet. Also, let OR be the direction which their resultant would take were the body extended to O and the forces there applied. Suppose now that, in order to extend it, a round bar of iron of uniform thickness is firmly soldered to it, so as to include the line OR within its substance. The body being thus extended, O may be considered a point of application of both forces, which we may conceive to be transferred to it by two thin but strong wires, OA , OB , the mass of which is so small that it may be neglected in comparison with that of the body. The forces A and B then evidently

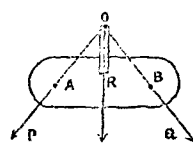


Fig. 10.

become one force, acting along OR on rod and body together, and producing the same effect on both as though they acted at A and B . But the effect taken separately of the resultant on O , and therefore of A and B , is evidently the same—namely, a pressure along its length. Their effects, therefore, on the body itself taken separately must be the same; and O , although outside, may be considered a point of application. The two forces are reducible to one applied to the body at any point on the line OR within the body.

TWO PARALLEL FORCES.

Third Case.—The resultant single force can be determined in this case also by the parallelogram of forces, but the proof given by the greatest mechanician of antiquity—Archimedes of Syracuse—is, with a slight alteration, much preferable, on account of its simplicity. I shall first take two equal parallel forces, which act in the same direction. Let A and B (Fig. 11) be the points of application, and their directions those of the arrow-heads P and Q . Suppose, moreover, that in magnitude they are each one pound, or ounce, or ton—say one pound. Now, in the first place, the resultant, whatever it be, must pass through the middle point of AB . The best reason I can give you for this is, that the resultant cannot, since the forces be equal, be nearer to one than to the other. If it were a tenth of an inch nearer to A , it should be also a tenth nearer to B .

Now, in order to find its magnitude and direction, let us suppose that two other forces, A and B , each equal to a pound, are applied to the body along the line AB in opposite directions. These being equal, and therefore of themselves balancing each other, can neither add to nor take from the effect of A and B , which may consequently be considered equivalent to the four forces, A , B , A , and B . Let the two at A be now compounded into one, acting in some direction between them (I care not which), and let the same be done with the two at B . Now produce these resultant directions backwards, until they meet at C , and transfer the resultants themselves to that point. Now resolve them back into their original components, and you have two pounds, OC , and OD , acting against each other parallel to AB , and two separate pounds pulling from O downwards parallel to A and B . The two former cancel each other, and there remain two pounds acting parallel to AB . Hence we can say, that—

1. If two equal parallel forces act on a body in the same direction, their resultant is parallel to either, and bisects, or divides equally, the line joining their points of application. 2. The resultant is in magnitude equal to their sum, or to twice either force. As an example to illustrate, take two equally strong horses pulling a carriage; two equal forces are applied to the splinter-bar, which give one force equal to double the strength of either horse acting at its middle point. When the carriage is backed, these forces are applied in the opposite direction directly to the centre through the pole.

We are now in a position to find the resultant of any two parallel forces, the first step towards which is to determine the resultant of any number of equal ones applied to a body at equal distances along a line. The number may be either odd or even. We shall consider each separately. First, take odd; and let it be seven, as in Fig. 12. Now, supposing each to be one pound, if we take the middle one, which is evidently at the middle of the line AB , we find that there are three pounds on either side of it acting in pairs at equal distances from M . The resultant of the nearest pair gives, as proved above, two pounds at M ; the next pair also give two, and so does the third. These make six pounds of resultant at M , which, with the single one already there, are seven pounds—the sum of all the forces for resultant. Were the number thirteen the conclusion would be the same. There would be six on either side of the middle one, and you would have a resultant of thirteen pounds; and the same holds good of any other odd number you select, be it large or small.

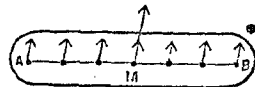


Fig. 12.

Now, suppose we have an even number of such forces, say six, as in Fig. 13, counting them from either end towards the middle, there will be no middle point; and the middle of the line AB will be in the middle of the space between the middle pair of forces. What have we then? The inside pair gives two pounds at M , so does the next outside, and so the next; and there are evidently thus six pounds of resultant at the centre of AB . Take any other even number, and the result is the same; and thus, for both odd and even numbers, we arrive at this conclusion:—The resultant of any number of equal parallel forces acting on a body at equal distances along a line, is equal to their sum, and bisects the line joining the points of application of the extreme forces.

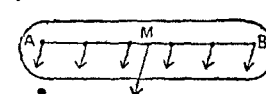


Fig. 13.

An instance of this is the working of a hand fire-engine. Suppose seven men at the lever on either side, that is, fourteen hands on each lever; supposing the men to be equally arranged and of equal strength, this makes fourteen equal forces applied at equal distances, the resultant of which is the muscular power of seven acting at the centre on either side.

Now we shall, without difficulty, find the resultant of two unequal parallel forces. As before, let A and B be their points of application, and let us first suppose that they act in the same direction. Measuring the forces by pounds, or ounces, or even grains, there are three cases which may occur. The number, say of pounds, in the forces may be both even, or both odd, or one odd and the other even. 1. We shall take "both even" first, and, for simplification sake, let them be six at A and four at B . Divide now the line AB into ten equal parts, that is, into as many parts as four and six together make. Extend also A on either side, as represented (Fig. 14) by the dotted lines, and measure off on the extensions any number of portions you please, each equal to one of the subdivisions of AB . Beginning at A , suppose you apply a pound force at the end of the first subdivision to the right, another pound at the end of the third, and so forth, until you come to B . You will find then that there will be a pound at the end of the first division from B . Put pounds now at the end of the first division from A on the dotted line, on the third, and on the fifth, and do the same on the dotted line from B , on the first and third. Count all the pounds you have; they are ten, five inside and five outside. Calling the points occupied by the extreme pounds P and Q , the resultant of these ten, so distributed at equal distances, must pass through the middle, M , of PQ , and be ten pounds, by the principle last established. But if we take separately the three outside and the three inside A , they make six pounds acting at A . Also the two pair on either side of B make four pounds at B . The ten pounds at M must therefore produce the same effect on the body as the six at A and the four at B ; and therefore must be the resultant of these forces; that is to say, the resultant is the sum of the components.

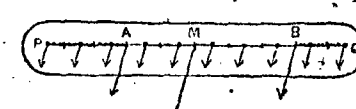


Fig. 14.

But count now the number of subdivisions on either side, from M to A and B . There are four on the side of A and six on the side of B —that is to say, the resultant cuts the line AB in the proportion of the numbers 4 and 6, with this peculiarity, however, that the smaller number is on the side of the greater force. This is what we might expect, for the resultant ought naturally to tend towards the greater, on account of its preponderance. When a line is cut in this way, the smaller portion being on the side of the greater number of pounds, it is said to be cut *inversely* as the two numbers—that is, in the *contrary* order. 2. Now let us take the case of two odd numbers; let them be 9 and 7. It is evident that if we put another 9 pounds at A , and 7 at B , the resultant of this second 9 and 7 should in every respect agree and coincide with that of the first, and that the resultant of the four should be the sum of two nines and two sevens. But the double 9 at A is 18 pounds, and the double 7 at B is 14 pounds. The case, therefore, becomes one of even numbers, and the line AB , as proved above, must be cut by the resultant in the *inverse* proportion of 18 to 14. But to divide a line so that there may be 18 parts one side and 14 on the

other becomes, by throwing every two of the subdivisions into one, the same thing as dividing it so that 9 may be on one side and 7 on the other. In this case then, also, A and B is divided *inversely* as the forces.

3. When the numbers are one odd and the other even, say 4 and 7, the result is the same. By doubling each force you get 8 and 14 pounds, both even numbers; the line AB is divided by the resultant *inversely* as 14 to 8, which is the same as 7 to 4 *inversely* as the forces.

We have supposed in all these cases that the forces contained an exact round number of pounds; but what should we do if there were fractions of a pound in either or in both? I say, reduce the forces to ounces, and work by round numbers in ounces. If there were fractions of ounces, work in grains. You can thus still secure round numbers, and the above proofs will hold good. But what are you to do if there are fractions of grains? Work them by tenths, or hundredths, or thousandths parts of grains, or by even far smaller fractions, and you will still have round numbers, and you can say that the resultant cuts AB *inversely* as these numbers, however great they be, and therefore *inversely* as the forces. To trouble you about smaller fractions would only get you into a cloud of metaphysics for no practical purpose.

I have proved this important principle only for particular even numbers, 6 and 4, but you will find that the reasoning will be the same whatever be the even numbers you choose. The rule simply is to divide the line AB into as many equal parts as there are pounds in both forces, and then to distribute all the pounds at A in two batches on either side of that point, and to do the same at B with the pounds there acting, observing to place the pounds as you go from A or B in any direction, at the first, third, fifth, and so forth, points of division.

You are now in a position to find the resultant of three or more parallel forces acting, say, at the points A , B , C , D , as in Fig. 15. First join A with B , and cut it *inversely* as the forces which are there applied; next join the point X so found with C , and cut the joining line at Y *inversely* as the sum of the two first forces to that at C ; join this again with D , and cut it *inversely* as the three first forces to that of D ; and so proceed until you have exhausted all the forces. The point Z last found is that through which the resultant of all passes, and is called the *centre of parallel forces*.

Suppose, for example, that the centre was required in the case of parallel forces of 1, 2, 3, and 4 pounds applied to the four corners of a square board, A , B , C , D (Fig. 16). First divide AB into three parts, and take two next to A and one to B . The point X so found is the parallel centre for these two forces. Join X now with C , and cut XC into six parts (the sum of 1, 2, and 3), and take three next to C and three to X . The centre Y so found, which evidently will be the middle of XC , is the centre of the three. Now join Y with D , and divide YD into ten parts (the sum of 1, 2, 3, and 4), and take four next to D and six next to Y . This last point, Z , is the centre of all the given forces. Try your own hands now on the following Examples, and in the next lesson we shall have for subject the centre of gravity, which is a centre of parallel forces.

Examples.

- Three equal parallel forces act at the corners of a triangle; find the centre through which their resultant passes.
- A force of a pound is applied to one end of a beam, of three at the other, and of two at the middle; find the centre of these forces, they being parallel to each other.
- A weight of one pound and three-quarters hangs from one end of a rod which is two feet in length, and of three and a-half from the other; find the magnitude of the resultant, and the centre of parallel forces.
- A door is seven feet high and three feet wide, and the centres of its hinges are distant one foot from its ends. A force of twenty-three pounds is applied along its upper edge, pulling it off its hinges, and one of thirty-seven along the lower. Find the strains on the hinges.

READINGS IN GERMAN.—IV.

4. Der Morgentraum.

Dair mör'-ghen-trom.

Ein kleiner Knabe, Namens Leopold, kam des Morgens
ine kl'ner knah'-bai, nah'-mens ley'-o-pödt, kahm dess mör'-ghens
hernieder aus seinem Schlafkammerlein und meinte kitzelnd,
herr-neo'-der ouss zi'-nem schlaf-kem-mor-line dönt vine'-tai bit'-ter-ly,
also daß ihm die Thränen über die Wangen liefen. Sein Vater
al'-zo dass eem dee trey'-nen a'-ber dee vang'-en leo'-fen. Zine fah'-ter
aber und seine Mutter traten bestürzt hinzu, denn sie
ah'-ber dönt zi'-nai mödt'-ter trah'-ten bai-shtärst'-hin-tsoo', den zee
meinten, es sei dem Kinde ein großes Uebel bezeugnet, oder
mine'-ten, ess zi daim kin'-dai ine gro'-sness u'-bel bai-gyng'-net, o'-der
es sei krank und empfinde heftige Schmerzen und Reizen im
ess zi krank döntem-pfin'-dai hef'-ti-gai shmer'-tsen dönt ri'-ssen im
Haupt oder in den Gliedern. Und sie fragten das Kind, um
haupt o'-der in dain glee'-dern. Dönt zee frach'-ten dass kint, dönt
sprach: Liebes Kint, was schiefst du, wer hat dir was zu
shprah'-chen: Lee'-bess kint, vass ley'-let deer, veyr hat deer vass tsoo
Leide gethan? Da that das Kind seinen Mund auf und sprach:
K'-dai gai-tahn? Dah that dass kint zi'-nen mödt out dönt shprah'-ch:
Ich ich hatte vorher zwölf nictliche weiße Schäfchen, und
ach ly hat'-tai fore-heyr twölff neet'-ly'-jai vi'-ssi sheyf'-yen, dönt
sie gingen um mich her und leckten mir die Hand, und ich
zee ghing'-en öm my heyr dönt leek'-ten meer doe haut, dönt ly
sah unter ihnen mit einem Hirtenstab. Aber nun sind
zahss dönt-er ee'-nen mit i'-nem hirt'-ten-stab. Ah'-ber noon zint
sie alle fort und ich weiß nicht, wo sie geblieben. Als er
zee al'-lai fört dönt ly vice nlyt, vo zee gai-blo'-ben. Aiss eyr
dieses gesagt hatte, begann er von neuem kitzelnd zu
dee-zess gai-zah'-ch hat'-tai, bai-gan eyr fon noi'-em bit'-ter-ly tsoo
weinen.
vi'-nen.

Da merkten die Eltern die Noth des Kindes und daß es
Dah merck'-ten dee el'-tern dee not'-dess kin'-dess dönt dass ess
ein Traum gewesen, und sie lächelten unter einander heim-
ine troum gai-vey'-zen, dönt zee ley'-y'-el-ten dönt-ter ine-an'-der hime'-
lich. Der Vater aber sprach: Wir lächeln wohl, Mutter, und
ly. Dair fah'-ter ah'-ber shprah'-ch: Veyr ley'-y'-eln vole, mödt'-ter, dönt
doch sind unsre Seufzer und unser Unmuth oft die Thränen
dönt zint dönt-zai zoll'-teer dönt dönt-zer, dönt-moot oft dee trey'-nen
res Kindes, und unser Wünschen und Verlangen, gleichet es
dess kin'-dess, dönt dönt-zer vün'-shen dönt ferr-lang'-en, gli'-yet ess
nicht oftmals Pollys Träumen?
nlyt oft-mah'-less pöl'-leess troi'-men?

Polly aber war noch immer sehr betrübt um die zwölf
Pöl'-lee ah'-ber vahr noch im-mer zeyr bai-trü'-pt' dönt dee tswölff
Schäfchen. Da berathschlagten die Eltern ernstlich, was zu
sheyf'-yen. Dah bai-ralt'-shlah'-ch-ten dee el'-tern ernst'-ly, vass tsoo
ihnen sei, und der Vater erhob sich und sprach: Polly, ich
toon zi, dönt dair, fah'-ter err-hope' zly dönt shprah'-ch: Pöl'-lee, ly
will gehen und seine Schäfchen suchen. Und er ging und
vill ghey'-hen dönt di'-nai sheyf'-yen zoo'-chen. Dönt eyr ghink dönt
kaufte ein Lamm und brachte es und stellte es so, daß
kounf'-tai ine lam dönt brach'-tai ess dönt sthell'-tai ess zo, dass
ter Knabe es sah. Da ward der Knabe sehr erfreut und
dair knah'-bai ess zah. Dah vart dair knah'-bai zeyr err-froi'-t dönt
sah hingu und hezte das Lammchen und sprach: Ja, das
leek hin-tsoo' dönt herrts'-tai dass lem'-y'en dönt shprah'-ch: Yah, dass
ist es, das ist es! ebenso sah es aus! und er war sehr
ist ess, dass ist ess! ey'-ben-zo zah ess ouss! dönt eyr vahr zeyr
erfreut, aber von dem elf andern Lammern sagte er nichts
err-froi'-t, ah'-ber fon dain elf an'-dern lem'-mern zah'-ch'-tai eyr nlyts
und beehrte ihrer nicht.
dönt bai-ghey'-tai ee'-rer nlyt.

* Like it in mirror.

Da lächelte der Vater abermals und sagte zu
Dah ley'-y'-el-tai dair, fah'-ter ah'-ber-mah'-less dönt zah'-ch'-tai tsoo
der Mutter: In Träumen und Thränen gleichen wir Großen
dair mödt'-ter: In troi'-men dönt trey'-nen gli'-yen veyr gro'-ssen
wohl dem kleinen Polly. Möchten wir auch nur in Genügsam-
vole daim kin'-nen pöl'-lee. Möy'-ten veyr ouss noor in gai-nü'-y'-zahm-
keit und bescheidener Freude an dem Kleinen und Wenigen
kite dönt bai-shi'-dai-ner froi'-dai an daim kin'-nen dönt vey'-nighen
ihm ähnlich sein.
eem eyr'-ly zine.

VOCABULARY.

Traum, m. dream.	Ueb, n. limb.	Wir, we.
Knabe, m. boy.	Fragen, to ask.	Seufzer, m. sigh.
Nieder, down, nether.	Fehlen, to ail, miss,	Unmuth, m. gloom.
Schlaf, m. sleep.	fail, lack.	Oft, often.
Kammer, f. chamber.	Wer, interrogative	Wünschen, to wish; n.
Bitterlich, bitterly.	pronoun, who.	wishing.
Also, so.	Zu Leide thun, to do	Verlangen, to demand;
Wange, f. cheek.	harm.	n. longing, de-
Laufen, to run.	Auffun, to open.	mand.
Streten, to step.	Mund, m. mouth.	Gleichen, to resemble.
Bestürzt, perplexed.	Bevor, before.	(Gleich, alike.)
Meinen, to think, to	Zwölf, twelve.	Immer, always.
mean.	Niclich, pretty.	Berathschlagten, to con-
Es sei, there was,	Weiß, white.	sult.
there had.	Schaf, n. sheep.	Ehrlich, seriously.
Begegnen, to meet,	Lecken, to lick.	Suchen, to look for,
happen.	Sitzen, to sit.	to seek.
Größ, great, large,	Unter, among, under.	Lamm, n. lamb.
big.	Ihnen, dative of sie,	Stellen, to place, to
Uebel, n. evil.	to them, them.	put.
Der, or.	Hirt, m. shepherd.	Erfrut, rejoiced.
Es sei, it was, it	Stab, m. staff.	Sorgen, to caress.
were.	Fert, away, forth.	Aussehen, to look.
Krank, sick.	Wissen, to know.	Gif, eleven.
Empfinden, to feel.	Wo, where.	Begegnen, to demand.
Seufzig, violent.	Er, he.	Genügsamkeit, f. con-
Schmerz, m. pain.	Dieser, diese, dieses, this.	tentment. (Genug,
(Schmerzen, to pain,	Merken, to perceive,	enough.)
smart.)	to notice.	Bestehen, modest.
Reißen, n. tearing	Noth, f. distress, need.	Freute, f. joy.
(acute pains), v.a.	Gewesen war, had	Wenig, little.
to tear.	been.	Ähnlich, like, resem-
Haupt, n. head, chief.	heimlich, secretly.	bling.

KEY TO EXERCISES IN LESSONS IN GERMAN.

EXERCISE 99 (Vol. II., page 118).

1. Lehrt eure Kinder gute Sitten nachzuahmen. 2. Er ahmt seinem
Vater in allen seinen Gewohnheiten nach. 3. Vermuthliche Eltern fluchen
dem unartigen Betragen ihrer Kinder bei Zeiten. 4. Steure muthig das
Schiff durch die wogende See. 5. Es begegnete ihm oft, daß er sein Buch
suchte und es in seiner Tasche fand. 6. Die Schiffe, welche nach Australien
gehen, müssen den Aequator passieren. 7. Sie setzten das Beispiel Ihres
Väters nachzuahmen suchen. 8. Ich sehe seine Unschuld in seinem Betra-
gen. 9. Die Unsterblichkeit der Seele leugnen ist so viel als Gott abschwören.
10. Die Polizei verhaftete sich des Diebes. 11. Ich meinte das Gute nach,
aber nie das Böse.

EXERCISE 100 (Vol. II., page 118).

1. The prince who ill-treats his people is called a tyrant. 2. He
asks me about things which I cannot tell him. 3. Call me what you
like, but not a traitor. 4. Those people must be called hypocrites who
speak fair but act basely. 5. They have christened the princess Louisa.
6. I did not ask him for this out of curiosity. 7. Attila, King of the
Huns, called himself the scourge of God. 8. I call him a friend who
does not remind me of my excellencies, but affectionately of my errors.
9. He calls all those who are not with him, enemies and rebels. 10.
The teacher called the scholar a lazy boy. 11. I asked him his name
in vain. 12. I do not deserve that the people should call me a traitor.
13. I give you this keepsake as a testimony of my love and respect.
14. How gladly do parents pardon their children the faults that have
been committed, when they heartily repent of them. 15. He narrated
to me the history of his life several times. 16. They pardoned me my
wrong, and held out their hands to me in proof of their reconciliation.
17. It is well for the man on whom nature bestows a healthy mind and
a clear understanding; but still better for him on whom it has be-
stowed a humble and modest heart.

EXERCISE 101 (Vol. II., page 119).

1. Mentor lehrte Telemach die Kunst zu regieren. 2. Man wird ihn
diese Sprache lehren. 3. Die Vergangenheit giebt dem Menschen die beste
Lehre für die Zukunft. 4. In seinem letzten Briefe schrieb er mir folgende
Neuigkeit. 5. Die Reichen sollten mit Freuden den Armen ein Weniges
von ihrem Ueberflusse mittheilen. 6. Er zeigte mir die Schönheit der
Natur. 7. Ich vertraute ihm das Geheimniß in der Absicht an, seine Ver-
schwiegenheit und Treue zu erproben. 8. Gorgey wird von seinem eigenen
Vello ein Verräther seines Vaterlandes genannt. 9. Er schalt mich
einen Thoren, da ich mich weigerte, den Grundsätzen zu folgen, welche mit
meinen Neigungen nicht übereinstimmen. 10. Der „Popular Educator“
lehrt die englische, französische, und deutsche Sprache auf die leichteste Weise.
11. Mein Gegner reichte mir die Hand zum Zeichen seiner Versöhnung.

EXERCISE 102 (Vol. II., page 119).

1. The children could not go out for a walk on account of the bad
weather. 2. On this side of the river there is a beautiful country-house.
3. He does it for the sake of the honour. 4. Within the town hunger
and despair prevail. 5. Beyond the mountain there is a beautiful
valley. 6. By virtue of his office he arrested the thief. 7. According
to his letter we expect him to-day. 8. Along the stream stand many
poplar trees. 9. He drew him up by means of a rope. 10. He came
into this house by means of a false key. 11. Above the bridge stands
a cross. 12. Instead of coffee he drinks water. 13. In spite of the
heavy rain, he takes a walk. 14. Below this village lies a beautiful
meadow. 15. Notwithstanding his father's prohibition, he went to
the theatre. 16. I saw a large bird near this forest. 17. He can assist
the poor by means of his riches. 18. He looked very pale lately
(during the last time). 19. The rich inhabitants fly on account of the
war. 20. He returned in consequence of his promise.

EXERCISE 103 (Vol. II., page 119).

1. Trug seiner Erwartungen that er es. 2. Ich befand mich ganz glück-
lich unter dem niedrigen Dache jenes Landmannes. 3. Alles unter der
Erne ist der Veränderung unterworfen. 4. Was hatten Sie zum Nach-
tisch außer Melonen und Trauben? 5. Die armen Auswanderer hoffen,
jemals des Meeres besser zu leben. 6. Er beharrte trotz aller Widerstände.
7. Die Gallier nahmen ihren mühevollen Marsch längs der Seefüste. 8.
Es ist unter der Würde eines christlichen Mannes. 9. Greenwich ist inner-
halb fünf Meilen von London. 10. Seines Alters wegen sollte er gelehrt
werden. 11. Kraft seiner Geburt ist er ein Edelmann.

RECREATIVE NATURAL HISTORY.

THE RAT AND MOUSE.

The rat and mouse are common animals, too common indeed
to need much minute description, for they are found nearly
wherever man has settled, from the Faroe Isles in the North to
the Falklands in the South, and on many an island in the
torrid zone, and, like him, they are good colonisers. This is
pre-eminently the case with the rat. And just as it has hap-
pened in the history of man that a weak human race has had
to give way before a stronger, and in the end has been nearly
exterminated, so likewise has it been in the progress of rat
colonisation. The parallel is a striking one, and even the
savage sees it. The Maori looks forward with gloomy fore-
boding to the time when his race shall become extinct; when
the beauties of New Zealand shall be alone for the eyes of
emigrants from the Western Hemisphere, and, like a philoso-
pher, he perceives that he has companions in misfortune, for
has not the black rat, on which his fathers dined, been almost
exterminated by the detestable brown rat from Europe? What
has happened in New Zealand has happened in other countries,
in our own for example, where the old English rat, or black
rat, has been displaced in a good many localities by the brown
rat. Many will have been the encounters the black rat has had
with its all-conquering rival. But when the interests of nearly-
allied animals like these clash, quarrel is seldom given. It is a
severe struggle for existence, and the fittest survives. The
brown rat has so far proved itself the fittest, for it has con-
quered several other species throughout Europe, parts of North
America, in New Zealand, as we have already seen, and
recently in Formosa, as well as on the mainland of China. Mr.
Swinhoe has described the two latter cases, and attributes the
victory of the brown rat over the large *Mus Coninga* to its
superior cunning. The habitual exercise of all its faculties in
avoiding extirpation by man may have developed this cunning,
but on the other hand it may be that its success over its

follow-species has been due to a superior cunning possessed
before it came associated with man.

The brown rat (*Mus decumanus*) is also called the Norway
Rat. It is not known for certain where it first came from. It is
not a native of our country, and some suppose that it came
originally from the Levant, and that it was first landed in
Ireland by ships trading in provisions to Gibraltar. It may
have come, as Pennant thinks, from the East Indies. But
wherever it originally came from, it is now widely distributed
over the earth's surface, and it rides, an unwelcome voyager,
in our ships on every sea. Hence, wherever man opens out
new commercial fields, there it soon settles, and holds absolute
sway over its kind. They live and thrive on board ship to an
alarming extent, and must owe their introduction to many
countries to having been delivered there with parts of cargoes.
Its first appearance in England is said to have occurred about
the middle of the last century. But where is it not to be found
now? It is a ferocious animal, and this, coupled with a certain
degree of intelligence, generally directed against the interests
of man, makes it a pest wherever it has chosen to take up its
abode.

So far as food is concerned, it will subsist on corn, seeds, and
the fodder provided for our beasts of burden, but it appears to
have a decided preference for animal food. They have exhibited
their voracity at the horse slaughter-houses of Montfaucon,
near Paris, in an alarming manner. The carcasses of horses
slaughtered during the day-time, sometimes to the number of
thirty-five, have been picked to the bone in the course of a
single night.

In a well known poem, Southey has given us an example of
the voracity of the rat in the fearful end which befel the wicked
Bishop Hatto. It was a time of famine in Mayence, and the
starving poor importuned the Bishop to give them food from
his well-stored granaries. To get rid of them, he invited them
to his large barn, and when it was as full as it could hold of
women and children, he made fast the door, and set the barn on
fire. In the morning, after a good night's sleep, he found upon
entering his hall, that the rats had eaten up his picture out of
its frame. A messenger next came to tell him that the rats
had eaten up all the corn that was stored in his granaries. He
was then obliged to fly before them for fear of being devoured,
and he took refuge in his tower on the Rhine. Here, however,
the rats found him,

"And in at the windows, and in at the door,
And through the walls helter-skelter they pour,
And down from the ceiling, and up through the floor,
From the right and the left, from behind and before,
From within and without, from above and below,
And all at once to the bishop they go.

"They have whetted their teeth against the stones,
And now they pick the bishop's bones;
They gnawed the flesh from every limb,
For they were sent to do judgment on him."

On the testimony of Mr. Robert Stevenson we have a more
modern instance of their determined ferocity and voracity, in
the death of a collier who met with Bishop Hatto's fate. It
is thus recorded by Professor Bell:—"In a coal-pit, in which
many horses were employed, the rats which fed upon the fodder
provided for the horses had accumulated in great multitudes.
It was customary in holiday times to bring to the surface the
horses and fodder, and to close the pit for the time. On one
occasion when the holiday had extended to ten days or a fort-
night, during which the rats had been deprived of food, on
reopening the pit, the first man who descended was attacked by
the starving multitude, and speedily killed and devoured."

There can be no doubt, after a consideration of the facts we
have laid before the reader, that the rat is possessed of a fair
share of intelligence, and this appears to be further proved by
another order of well-attested facts. A plumber having been
called in to examine into the cause of leakage of water-pipes
under the flooring of a house, found a hole gnawed in the
lead pipes, which had been made by the rats. There could
be no mistake about the agent, as the marks of the rat's incisors
were to be seen on the lead as clear as an engraving. The hole
had evidently been made for drinking purposes, and here the rats
had collected to quench their thirst. The question arises,
What led them to find out that there was water in the pipes?

It has been argued that it was a process of reasoning in a practical fashion. Thus the rats may have heard a trickling noise which they judged was produced by water, and as they were in want of pure water, they forthwith commenced to bite their way through the lead piping for it.

The brown rat breeds several times during the year, having ten to fourteen young ones in a litter. It has comparatively short ears; its throat and belly are of a dirty white, and the upper part of its body of a light brown. It is about nine inches long.

The black rat (*Mus rattus*), or old English rat, is smaller than its inveterate enemy, and appears less energetic from the fact of its having been displaced so universally by it. The black rat has comparatively larger ears than the brown rat, and its upper surface is of a brownish-black colour, while its under surface is of a dark ash colour. It is about seven inches long. It is supposed to have come originally from Southern Asia.

Rats of all colours—black, brown, and white—are supposed to be polygamous. Nevertheless, the males in a colony, according to many observers, exceed the females in number. Mr. F. Buckland found this to be the case with a large number of white rats that he brought up.

They are exceedingly destructive animals, and their rapid multiplication makes them an enemy the farmer has good reason to fear. Their known delight in certain strong scents, such as the oils of rhodium, caraway, and aniseed is often taken advantage of to destroy them. A rag, which has not been in contact with the human body, is impregnated with one of these substances, and laid as if by accident in some place to which they have access. When they have become accustomed to the place they are further enticed by bits of tallow, &c., and finally poisoned bait is laid in sufficient quantity to poison all the rats that frequent the locality.

The common mouse (*Mus musculus*) belongs to the same family of gnawing animals, or rodents, as the rat. It is a pretty little animal, as the reader will have seen in the occasional glimpses he may have caught of it when it has been surprised in some predatory exploit; and no doubt he has often likewise seen it when a prisoner within a cage of wire little over a foot long and a few inches wide. Tempted by the bit of cheese within the cage, it ventured in, and upon biting the dainty morsel, heard a sudden snapping sound which sent a thrill of fear throughout its little body. It madly rushed to the entrance to find it closed. It hastily ran all round, but not a single place of exit could it find; it was surrounded by strong wire bars. I am sure the reader pitied it.

The mouse is associated with man as much as the rat, and has accompanied him to nearly all climes. It haunts our houses, and takes up its abode in the rick-yards, where it is very destructive. It is not surprising, therefore, that it has figured in the literature of all countries as the subject of both poem and fable.

The peculiar shrill noise which it makes will immediately cause its natural enemy, the cat, to prick its ears, and be on the alert for what it doubtless considers its legitimate prey.

Some mice have also been known to vary the pitch of the note they emitted in such a manner as to earn the name of singing mice. Specimens of such mice have often been exhibited, but imposture has been commonly suspected. A well-known observer, however, has placed on record what was heard with his own ears of the performance of an American species of mouse, the *Hesperomys cognatus*, belonging to a genus distinct from that of the English mouse. Mr. Lockwood, the observer referred to, says that in one of the two chief songs that were sung by his imprisoned mouse, "the last bar would frequently be prolonged to two or three; and she would sometimes change from C sharp and D to C natural and D, then warble on these two notes awhile, and wind up with a quick chirp on C sharp and D. The distinctness between the semitones was very marked, and easily appreciable to a good ear."

There are two kinds of British mice which do not live in houses, the long-tailed field mouse (*Mus sylvaticus*) and the harvest mouse (*Mus minutus*). They dwell in fields and gardens.

The long-tailed field mouse is about four inches long, of a yellowish-brown colour above and whitish beneath. Its tail is as long as its body, and brown above and white beneath. It burrows under the ground, or utilises deserted mole-runs, laying up there a considerable store of grain and seeds for winter use. It does not confine itself exclusively to a vegetable diet, however, as it will devour smaller and weaker animals than itself in times of scarcity. The short-eared owl is one of the most efficient agents of its destruction.

The harvest mouse is a tiny little creature, so light, weighing about the sixth part of an ounce, that it can run up corn stalks with the same facility as a monkey would run up a palm tree. It feeds on grain of various kinds, worms, flies, and other insects. When full grown its body is about two and a quarter inches long, and its

tail is nearly of the same length. It is of a reddish-brown colour on its upper surface and pure white below.

The harvest mouse has one of the prettiest nests devised by a mammal, and, in making it, exhibits considerable constructive skill, which is further improved as the little architect grows older. A bird's nest is a truly admirable piece of work, and Hurd's has enlorged it in some fine lines which are equally applicable to the work of the harvest mouse, for we may say of this little animal that it has no tool to work with, no knife to fix, no bodkin to insert, yet its work is nicely finished, and it would take a long apprenticeship to make such another. The building, indeed, bears considerable resemblance to the nests of the Tomtit. The interior of the nest is padded with all sorts of soft vegetable substances, and the exterior is of the shape and size of a goose's egg, and is formed of interwoven slit grass. Each blade of grass is carefully divided lengthwise by the mouse's teeth into six or eight filaments, and these are crossed and intertwined so as to produce a firm exterior. The nest is generally at a height of a foot and a half to three feet above the ground. In winter, the harvest mouse takes refuge in corn or hay-ricks, or scratches out a burrow, which it lines with wool, hair, or other soft substances.



HARVEST MICE.

LESSONS IN CHEMISTRY.—XIX.

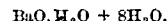
CLASS II.—METALS OF THE ALKALINE EARTHS: BARIUM, STRONTIUM, CALCIUM, AND MAGNESIUM.

BARIUM.

SYMBOL, Ba — COMBINING WEIGHT, 137.

Of this metal in a free state but little is known. It may be got by the action of electricity on fused barytic chloride, the negative wire dipping into a globe of mercury, which is in the fused salt, and with which the liberated barium forms an amalgam. The mercury being driven off by heat, barium is left behind as a powder. This process must be conducted in an atmosphere not containing oxygen.

Baryta (BaO) is best obtained by decomposing barium nitrate by heat. It is a grey, porous mass, which combines energetically with water, forming the hydrate BaO.H₂O. This compound is to some extent soluble in water, which then forms barytic water, and offers a delicate test for carbonic and sulphuric acids, barium carbonate and sulphate being white insoluble powders, which fall as precipitates. When barytic water is evaporated, crystals of this composition are deposited—



Barytic Peroxide (BaO₂) has twice been alluded to. It is produced when baryta is heated to a red heat in an atmosphere containing oxygen.

Barium Chloride (BaCl₂) is obtained by dissolving barium carbonate in hydrochloric acid. It may be obtained in crystals containing two atoms of water of crystallisation. A solution of this salt is a usual test for sulphuric acid, with which it forms a white precipitate insoluble in nitric acid.

Barium Sulphate (BaSO₄), or Heavy Spar, is the principal native mineral of baryta. From its high specific gravity, 4.59, the element has taken its name (*Barys*, heavy). It occurs in veins in mountain limestone. It is utterly insoluble in water and all acids except boiling sulphuric acid. It is used as a permanent white by water-colour artists, and is the chief adulterate of white lead.

Barium Carbonate (BaCO₃), or Witherite, is abundantly found in the lead mines in the north of England. At a high heat it will part with its carbonic acid, leaving barytes (BaO).

Barium Nitrate (Ba(NO₃)₂) may be prepared by dissolving the carbonate in nitric acid.

Barium Sulphide (BaS) is obtained by heating finely-ground coal mixed with barium sulphate. A solution of this salt dissolves sulphur, forming BaS₂ (barium penta-sulphide). If cupric oxide be added to a solution of the sulphide, the copper takes the sulphur, leaving the hydrate of baryta in solution.

There are some other salts of less moment. All the salts of barium are colourless, and those which are soluble are powerful poisons. They are all recognised by giving the heavy white precipitate with sulphuric acid. They tinge the alcohol flame yellow, and the spectrum of barium is characterised by green lines. Barium is distinguished from strontium by yielding no immediate precipitate with oxalic acid. After some time, however, tufts of acicular crystals of barium oxalate are deposited.

STRONTIUM.

SYMBOL, Sr — COMBINING WEIGHT, 87.5.

Strontium closely resembles barium, but is found in much less quantity. The metal may be procured in the same way as barium, and is found to be malleable, possessing a pale-yellow colour. Its chief sources are the sulphate (*celestine*) and the carbonate (*strontianite*).

Strontia (SrO) is obtained by heating the nitrate. It slakes with water like baryta. There is no peroxide of strontia.

Strontium Sulphate (SrSO₄) owes its mineralogical name of celestine to the delicate blue tint which many of its specimens possess. It is frequently found with heavy spar. It is slightly soluble in water, which solution is capable of precipitating barytic salts.

Strontium Carbonate (SrCO₃) is called *Strontianite*, since it occurs near Strontian, in Argyshire, and hence the name of the element.

The nitrate and chloride are both soluble in water, and are used by pyrotechnists to impart to their fires the splendid crimson colour. The favourite red fire is a mixture of forty parts of strontium nitrate, seven of potassium chlorate, thirteen of sulphur, and four of sulphide of antimony; but the greatest caution must be used in its preparation.

CALCIUM.

SYMBOL, Ca — COMBINING WEIGHT, 40 — SPECIFIC GRAVITY, 1.56.

This metal may be got by the decomposition of its chloride by the galvanic current. It is of a light-yellowish colour, rather softer than lead, melts at a red heat, and is malleable. The salts of this metal occupy a prominent place in the composition of the earth's crust.

Calcium Oxide (Lime), CaO.—This, the only oxide, is obtained by heating to redness any carbonate of lime. This process is usually carried on in a lime-kiln, which is an egg-shaped cavity, with a fire-grate at the bottom. Chalk or limestone is flung into the kiln, and the fire kept burning for three days and nights. The carbonic acid is driven off, and lime left. In this condition it is said to be *quicklime*. When water is added to it, the two chemically combine, forming—

Slaked Lime, or the Hydrate of Lime (CaO.H₂O).—During this process great heat is evolved, which has often proved sufficient to set fire to carts or ships laden with quicklime. Quicklime is soluble in 700 parts of cold water, forming *lime water*. When the hydrate of lime is mechanically diffused through water, *milk of lime* is produced.

Mortars and Cements.—Slaked lime, when mixed with water, becomes a solid as it dries, but in this state it cracks and falls to pieces. The addition of sand is found to remedy this; hence ordinary mortar is prepared by mixing into a paste one part of lime and three parts of tolerably fine sand. The hardening of mortar is scarcely understood. However, it is mainly due to the absorption of carbonic acid from the air, the lime thus returning into its original state of carbonate. There is also some action between the sand and the lime, in which a silicate of lime is formed.

When lime contains from 20 to 30 per cent. of finely-divided silica or clay, it possesses the property of hardening under water. The cause of the solidification of this, an *hydraulic mortar*, appears to be the formation of a compound with silica and alumina, which is insoluble in water.

Roman Cement is one of these hydraulic mortars, and is a porous, volcanic material, originally obtained at Puzzuoli, near Naples. It is now chiefly prepared from nodules of septaria, which are dug out of beds of clay in the valley of the Thames, on the coast of Yorkshire, and in other localities.

Portland Cement is made from clay obtained in the valley of the Medway, four parts of which are mixed with one part of chalk, and these thoroughly ground together with water; the mixture is then dried and burnt, the mass is again ground, and when mixed with water, forms a cement of great hardness. It derives its name from the fact that when dried it resembles Portland stone.

Calcium Carbonate (CaCO₃) appears as chalk, limestone, marble, and coral. It also composes the shells of animals, eggs, etc. When crystalline, it is known as *calc spar*, and, if transparent, as *Iceland spar*. The crystals are rhombohedrons of the hexagonal system, by which it is readily distinguished from quartz and from fluor-spar. In Fig. 49, *a* represents a cluster of quartz crystals, which are six-sided pyramids terminating in prisms; *b* are crystals of fluor-spar, which are cubes, all the angles being right angles; *c* represents a crystal of calc spar, which is a rhombohedron.

Iceland Spar possesses the property of double refraction—that is, when a ray of light traverses it in any save one direction, the ray is divided into two. The phenomenon is exhibited by the parallel horizontal lines in Fig. 49c.

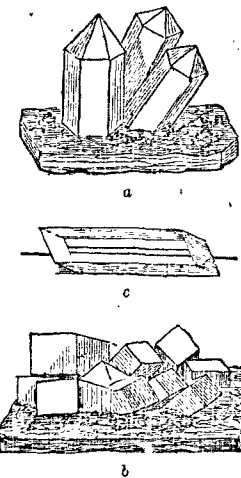
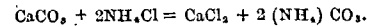


FIG. 49.—*a*, QUARTZ CRYSTALS; *b*, FLUOR SPAR; *c*, CALC SPAR.

There is a form of calc spar, called *aragonite*, which appears in six-sided prisms; hence carbonate of lime is said to be *dimorphous*. In the lesson on "Water," it was said that although carbonate of lime is insoluble in pure water, yet if any carbonic acid be present, the water becomes capable of holding this salt in solution, rendering the water *hard*. By using such water, thick crusts become deposited in boilers. This evil, however, may be obviated by the addition of a little sal-ammoniac to the water. By a double decomposition, soluble calcium chloride and volatile ammonium carbonate are formed—



Calcium Sulphate (CaSO_4) is found combined with two molecules of water, as *gypsum* or *plaster of Paris*. When transparent it is named *selenite*. When heated to 130° , it decrepitates on giving up its water of crystallisation. When this powder (plaster of Paris) is made into a paste, the mixture "sets" in a few moments. Stucco is plaster of Paris mixed with a solution of size.

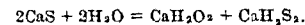
Calcium Chloride (CaCl_2) is formed when marble is dissolved in hydrochloric acid. When crystallised it contains six atoms of water. When heated it parts with four of these atoms, and the porous mass which remains, exhibiting a great avidity for moisture, is used in the laboratory for drying gases.

Bleaching Powder has been before treated of.

Calcium Fluoride (CaF_2), or *Fluor-spar*, the *Blue-John* of the Derbyshire miners, crystallises in cubes (Fig. 49b). Its colour varies. Rose colour is the most rare, and purple the most common. It is sometimes used as a flux to reduce metals; hence its name.

Calcium Phosphate ($3\text{Ca}_2\text{PO}_4$) forms $\frac{2}{3}$ of the bones of animals, and is the source from which phosphorus is derived.

Calcium Sulphide may be formed by the action of sulphuretted hydrogen on red-hot lime. It is not soluble in water, but is gradually decomposed by it. Thus—



When milk of lime and flowers of sulphur are boiled together, a yellow solution is obtained, which consists of calcium pentasulphide (CaS_5) and calcium hyposulphite ($\text{CaO}_2\text{S}_2\text{O}_5$). There are other salts of lime of less moment.

MAGNESIUM.

SYMBOL, Mg—COMBINING WEIGHT, 24—SPECIFIC GRAVITY, 1.74.

Magnesium is closely allied to zinc and cadmium, but is generally placed in this class, since its oxide has an alkaline reaction. Its salts occur in the sea; but dolomite, or magnesium limestone, contains 35 per cent. of the carbonate. The metal may be prepared by heating together the chloride with sodium. Sodium chloride is formed whilst metallic magnesium distils into the receiver. It is a white metal, fuses at a low red-heat, and burns into MgO with great brilliancy at a higher temperature. The magnesium light is so rich in "actinic" rays, that it is used instead of sun-light for photographic printing.

Magnesia (MgO), the only oxide of the metal, is usually prepared by heating the carbonate as in the case of lime. Like that substance it forms an hydrate, but without an elevation of temperature.

Magnesium Chloride (MgCl_2) is obtained for the manufacture of the metal by dissolving one part of magnesia in hydrochloric acid, and adding three parts of sal-ammoniac in solution, then evaporating to dryness. By igniting this in a covered crucible, magnesium chloride alone is left.

Magnesium Sulphate (MgSO_4) is known by the name of *Epsom Salts*, since it occurs abundantly in the springs at Epsom. It is made in large quantities from sea-water, to which it imparts the bitter taste of all the soluble salts of this metal.

Magnesium Carbonate (MgCO_3) is found native as a mineral, called *magnesite*. The common magnesia of the shops is prepared by boiling magnesium sulphate and a solution of sodium carbonate. It is sparingly soluble in water; but if the water contain carbonic acid, it can take up a large quantity of the salt, forming "fluid magnesia."

Combined with silica, magnesia is found in many minerals. Soap-stone, meerschaum are hydrated silicates of magnesia. Serpentine, hornblende also contain magnesia. All the compounds of magnesia may be recognised by the fact that they acquire a pink tinge when heated with the nitrate of cobalt in the blow-pipe flame.

HISTORIC SKETCHES.—XXX.

THE PERSIAN POWER.

THE book of the prophet Daniel would alone be sufficient to make one desire to know more of Persian history than is given in the Bible. Full of interest, indeed, is the story of this ancient kingdom and of its people.

The very remote history of Persia is involved in much obscurity. The country was most probably, in spite of semi-independence, attached to a neighbouring empire, and certainly in the year 900 B.C. we find it forming an integral part of the Assyrian dominions, and when these fell to pieces Persia did not become free, but was incorporated in the kingdom of Media. The union was not a happy one, and the Persians sought every opportunity to break it off. They found themselves in the position of thralls to men of a civilisation inferior to their own, bound down strictly to religious rules and observances with which they had no sympathy. Even when they had succeeded in inoculating the minds of their masters with their own religion, the magi, the priest-rulers of Media, took upon themselves the administration of the priestly duties, and asserted in the most tender places the right of the strongest to dominate. The religion of the Persians was that which their own prophet or philosopher, Zoroaster, had taught them more than a thousand years before the birth of Christ. It had in the course of that time become corrupted, inasmuch that the original belief in one supreme God had become almost lost. Upon a comparatively pure system all sorts of gross superstitions, borrowed from the nations with whom the Persians had to do, were engrafted, until the worship of the sun, moon, and stars, became a leading feature of the religion. Fire, as symbolising the light of the world, was worshipped by the disciples of Zoroaster, who did not however omit, as their descendants did, the adoration of Him who was symbolised by the fire.

Zoroaster was the first, we might also say the last, who endeavoured to reconcile in his creed the existence of moral and physical evil with the attributes of a beneficent Creator and Governor of the world. "The first and original Being, in whom or by whom the universe exists, is denominated in the writings of Zoroaster, *Time without bounds*." . . . "From either the blind or intelligent operation of this inflexible Time, which bears but too near an affinity with the chaos of the Greeks, the two secondary but active principles of the universe were from all eternity produced, Ormuzd and Ahriman, each of them possessed of the powers of creation, but each disposed, by his invariable nature, to exercise them with different designs. The principle of good is eternally absorbed in light; the principle of evil eternally buried in darkness. The wise benevolence of Ormuzd formed man capable of virtue, and abundantly provided his fair habitation with the materials of happiness. By his vigilant providence, the motion of the planets, the order of the seasons, and the temperate mixture of the elements are preserved. But the malice of Ahriman has long pierced Ormuzd's eggs, or, in other words, has violated the harmony of his works. Since that fatal irruption, the most minute particles of good and evil are alternately intermingled and agitated together; the rankest poisons spring up amidst the most salutary plants; deluges, earthquakes, and conflagrations attest the conflict of nature; and the little world of man is perpetually shaken by sin and misfortune. While the rest of human kind are led away captive in the chains of their infernal enemy, the faithful Persian alone reserves his religious adoration for his friend and protector Ormuzd, and fights under his banner of light in the full confidence that he shall in the last day share the glory of his triumph. At that decisive period, the enlightened wisdom of goodness will render the power of Ormuzd superior to the furious malice of his rival. Ahriman and his followers, disarmed and subdued, will sink into their native darkness; and virtue will maintain the eternal peace and harmony of the universe."

The simplicity of the Persian worship is vouched for by Herodotus; indeed, it seems to have impressed all who came in contact with it. "That people," says the Greek historian, "rejects the use of temples, of altars, and of statues; and smiles at the folly of those nations who imagine that the gods are sprung from, or bear any affinity with, the human nature. The tops of the highest mountains are the places chosen for sacrifices. Hymns and prayers are the principal worship; the

supreme God, who fills the wide circle of the heaven, is the object to whom they are addressed."

The Median kingdom was not of long duration. Itself originally a province of the Assyrian empire, it shook off the foreign yoke when that empire collapsed, and sprang almost immediately into importance. Allied with the rising power of the Babylonians, it gave the finishing strokes to Assyrian existence, and included within its borders the smaller but still strong province of Persia. Not without the exercise of much cruelty, and the exhibition of a ferocity which betokened the barbarian, were the Persians subdued; and it is probable that at no time was the country completely under subjection, unless it might be in the plains and lowlands, the warrior caste and the princes preserving in the highlands the spirit and even the form of independence. The Medes were almost afraid—they had good reason to be so—of the acquisition they had made. They saw in the superior intellects and greater knowledge of their subjects the signs of a power that might one day prove fatal to their rule, and they endeavoured by all the means at their disposal to conciliate them, though not till after they had made irreconcilable enemies of them. The Persians temporised, waited for their opportunity, and never ceased, while yielding nominal allegiance to the Mede, to look forward to the day when the tables should be turned, and when the one pure religion and the one Aryan (noble) race should be acknowledged as supreme.

So powerful had they become, and so threatening had grown the position of external enemies in the time of Astyages (called Ahasuerus in the book of Daniel), who reigned in Media about 565 B.C., that the Medes thought it advisable to conciliate the Persians in every possible way. Astyages gave his daughter to be married to Cambyzes, one of the chief of Persian princes, and a member of the royal house. The issue of this marriage was Cyrus, immortal in human history, and specially famous as the saviour of his country, the man who made the Medes exchange with the Persians the supremacy on the throne. This young man, seeing as he grew up the exact position of things, and ever mindful of what his countrymen had suffered at Median hands in the old time, conceived the scheme of overthrowing the dynasty and of seating a Persian upon the throne of the two kingdoms. Though scarcely arrived at maturity, he went through the land, inflaming the minds of the Persians by the remembrance of ancient wrongs; and making an opportunity, he unfurled his standard and marched against his grandfather Astyages, who was overthrown and flung into prison. Cyaxares II., a kinsman of Cyrus, was seated on the throne, while Cyrus pursued both against the Medes and Babylonians a series of brilliant conquests which made the Persian arms supreme in Asia. The Babylonian power he completely subverted, giving it the *coup de grace* when he captured the city of Babylon under circumstances which must be familiar to all readers of the Old Testament. "Belshazzar the king made a great feast to a thousand of his lords, and drank wine before the thousand." Relying on the enormous strength of the city walls and on the power of his army, contemptuous of the host of former subjects who had come to invade him, and careless in his supposed security, the Babylonian king took no military precaution to guard against the enemy that was encamped before his gates. Cyrus, recognising the great strength of the defences, gave them the go-by, unwilling to hurl his men to certain death when no advantage could be derived from the sacrifice. Whilst the Babylonians revelled and drank, whilst on their walls were appearing those dreadful and mysterious characters which none could decipher save the prophet of God, the Perso-Median troops were diverting the course of the river which ran through the city into a canal that had been dug for it, and which drained the river-bed. Along the bed the men of Cyrus marched, and coming into the terror-stricken city found no resistance worth speaking about. From point to point they went till they came to the royal palace, where Belshazzar was giving a dinner to a thousand of his lords. What happened there all must know. Even as the words of interpretation were being uttered by the prophet Daniel, the Persian warriors rushed into the hall; ruin was the desperate resistance of the guards, useless the valour with which Belshazzar himself and his companions at the feast drew their swords and stood at bay. In a few minutes the place was won; the prophecy, which even yet was discernible upon the wall, was dreadfully fulfilled; and the Babylonian kingdom, having been weighed in the balance and

found wanting, was then and there given over to the Medes and Persians. The end had come.

"Crownless and sceptreless Belshazzar lay,
A robe of purple round a form of clay."

Cyrus, under the direction of his uncle, Cyaxares II., who had accompanied the army, took military possession of the famous city, and having made it as strong as possible went back to Persia, laden with the almost fabulous wealth which successive Babylonian kings, notably Nebuchadnezzar, had accumulated. Cyaxares, anxious to secure the benefits of so fine a city, and glad of an opportunity which gave him, a Persian, the means of eradicating from the Median mind that there was any actual necessity for governing from their capital, moved the seat of his government to Babylon, a situation which also afforded a better base for those military operations which he contemplated against several other of the Eastern monarchies. Soon after this removal occurred the remarkable incident chronicled in the book of the prophet Daniel. The Persian king, called in the prophet's writings Darius, a title common to all the Median princes, and meaning simply "the king," began to persecute the priesthood which he found in Babylon. The Persians, as the worshippers of one God, and as followers of the simple and pure faith of Zoroaster, were extremely averse to the complicated and degrading superstitions which were common in all the countries around them. It had been the most galling part of their bondage to the Mede, that they had to submit to the interference of a powerful priesthood, which dominated to the exclusion of all that was noble and admirable in the national mind, and which sought only to establish its own power at the expense of whatever else might come in its way. Cyrus and Cyaxares, for the latter now associated his nephew in the government which that nephew had originally handed over to him, never lost an opportunity of showing their contempt and hatred for professional priesthoods and for the superstitions they taught. In Babylon they found a superstition and a priesthood worse than those of the Median magi. They determined, both as a matter of policy and of morals, to insult the power which held the people in awe, a power which, as they well knew, might at any time cause an insurrectionary spirit to spring up among the people, and which from their hearts they despised as being based upon imposture, ignorance, and falsehood. Among the prisoners at Babylon was a man, one out of thousands, to whom the Persian princes were drawn at once by the force of a religious and intellectual sympathy, as well as by his personal merits. Daniel, the prophet of the one God, the man who had dared even Belshazzar's wrath in testifying against the wickedness of Babylon, and in asserting the only adorable Jehovah, was the man whom Cyaxares singled out to help him in governing the new kingdom and in overthrowing the priesthood. The Persian and the Hebrew worshipped one God, though in different ways; and though the latter deemed it essential to proper worship that the service of God should be splendid and served by an exclusive priesthood, while the former held simplicity of worship without the intervention of priests to be the more acceptable sacrifice, yet the conditions under which the two met in Babylon prevented any clashing in this regard. Daniel was an exile, a fugitive, singing the Lord's song in a strange land, remote from Jerusalem, "where God ought to be worshipped," away from the possibility of partaking in those ceremonies and ritualistic performances which the Jews had been taught to look upon as so well-pleasing to God. Whatever he may have longed for, he could not at Babylon either celebrate or partake in any ceremonial of Jewish worship which might affront his new master. His prayers, his way of making his wants known to God, and his mode of worship, must have been as simple and unaffected as those of Cyrus himself. He was an alien, it is true; but so were the Persian princes themselves, not only among the Babylonians whom they had conquered, but also among the Medes by whose arms they had conquered. Herein was another bond of union. So Daniel was promoted to honour, apparently to the rank of grand vizier, in the Persian court. Cyrus was gone on military expeditions which took him to Egypt and to Syria; Cyaxares ruled alone, with the help of such assistance as the Hebrew prophet gave. We may reasonably suppose that some popular outburst of feeling on account of the priesthood, some fanatical piece of enthusiasm of the priests themselves, led him in a moment of

contemptuous anger to issue the famous decree that "whosoever shall ask a petition of any God or man for thirty days," save of the king, should be cast into the den of lions. The sequel is well known; the sorrow of Darius when he found where the punishment fell; the endeavours he made "till the going down of the sun, to deliver him;" the envious insistence of the Median and Persian princes upon the law of the Medes and Persians which altereth not; and how "the king commanded, and they brought Daniel, and cast him into the den of lions." The religious sympathy between the king and his great subject, the common belief they had in the might and goodness of a God who was King of kings and Lord of lords, was distinctly and clearly shown in the speech of Darius: "Thy God whom thou servest continually, he will deliver thee."

Soon after the delivery of Daniel from the lions' den, Cyaxares, who was sixty-two years old at the time of the capture of Babylon, died, and was succeeded in the sovereignty by Cyrus, B.C. 534. Cyrus, who had carried the Persian arms to the borders of Egypt, and but for the need of his army for refreshment might have done as his successors did to that country, devoted several years to consolidating at home the power he had won. Among the very first of his governmental acts was the issue of a decree that the Jews whom Nebuchadnezzar had brought into captivity should be free to return to their native land and to rebuild the walls of Jerusalem. This magnanimous act was due not only to gratitude for the help he had received from Daniel, but to an appreciation of the value which the Jewish civilisation had been to the half-barbarous people with which it had been so long in contact; it was the generous act of a truly liberal mind, which could agree to forego the manifest advantages of the Jews' presence out of deference to a belief that their compulsory residence in the land of their whilom conquerors was an oppressive and undesirable thing. For seven years he ruled with much satisfaction to his people and with glory to himself, and is said then to have been slain with a large number of his warriors in an expedition against the Scythians.

Cambyeses succeeding in the year B.C. 529, invaded Egypt, overran it, and inheriting the rancour of Cyrus against the sacerdotal castes, almost annihilated the Egyptian priesthood, at the same time that he restrained the priesthood in other parts of his dominions. Trying to penetrate too far into the African continent, he met with some grievous disasters, and returned home to find that, though he had put his own brother to death to prevent his being troublesome, there was a usurper in the field who claimed the crown. He died of an accidental wound from his own sword, and the usurper, a nominee of the magi and of the old Median party, was destroyed by the Persians, who raised Darius Hystaspes, one of their own nobles, to the throne. Darius carried out the old policy of Cyrus and Cyaxares so far as the home government was concerned, and crushed severely all attempts on the part of the Babylonians to regain their freedom. His foreign wars were carried on by himself in person, and were extended across the Danube into Scythia, where Cyrus had been killed, into Greece, and beyond the confines of India. It was the nascent period of the Greek dominion. Even on the return of Darius from his Scythian campaign, which nearly proved as fatal to himself as Cyrus' expedition into Scythia had been to him, the Greeks, under some of their ablest early generals, ventured to cross swords with him, and found, though defeated, that they had hope of learning from him how to conquer. The policy of the Greeks was to split up so overshadowing a power as that wielded by the Persian king, and they used every opportunity of carrying out this policy. Wars frequent and bloody were the consequence, and the strength of Persia, crippled as it was by Miltiades at Marathon (B.C. 490), was gradually undermined. As the inferior civilisations had given way to the Persian, so that was now to give way to the superior civilisation of the Greeks. Prodigious as the efforts of Xerxes, the successor of Darius, were, enormous as were the cost and equipment of his fleets and armies, they failed to make an impression upon the rock-founded states of Greece. Xerxes himself, after collecting such armies as had never before been heard of, after three years spent in preparations against the inevitable, returned home covered with disgrace; and the army he had left to cover his retreat, and to make a show of military dignity in retiring, was completely destroyed at the battle of Plataea.

From that time the Persian power toppled on the brink of ruin. Artaxerxes, the successor of Xerxes, who was murdered by his guards, for a few years revived the fading splendour of the empire; but he likewise in the end passed under the waters of adversity, and was compelled to sign treaties which Cyrus would not have touched with the tip of his sword. Another hundred years of fitful existence, and then the end came. Alexander of Macedon, gathering the reins of all Greek government into his own hands, was the incarnation of all that was strongest and wisest in the counsels of nations. At Issus and Arbela he completed the work which Miltiades began; and three hundred and thirty years before Christ, the Persian power, which had been all but universal, was laid low by those who in turn succumbed to the Latin race they once affected to despise.

LESSONS IN BOOKKEEPING.—XX.

FOREIGN TRADE (continued).

October 1st.		
Paid for Dock Dues, etc., on Sugar per the Ballarat.	£5 19 6	
2nd.		
Paid Tuelon and Co. their Bill of Parcels	£33 10 0	
Received discount at 2½ per cent. on do.	0 16 9	
Paid William Phillips his Bill of Parcels	256 15 6	
Received discount at 5 per cent. on do.	12 16 9	
Paid Thomas Barker his Bill of Parcels	250 16 6	
Received discount at 5 per cent. on do.	12 10 10	
3rd.		
Received of Peter Hutchinson and Co., of Liverpool, the following Remittances in Bills:		
No. 613, dated Aug. 12 on T. Salomons, due Oct. 15	£100 0 0	
" 614, " " J. Sidney, " "	150 0 0	
" 615, " " L. Dixon, " 21	120 7 6	
" 616, " " W. Turner, " "	170 0 0	
" 617, " " B. Hoole, " 23	200 0 0	
" 618, " " D. Hughes, " "	140 0 0	
4th.		
Paid W. Silver and Co. their Bill of Parcels	£87 10 0	
Received discount at 2½ per cent. on do.	2 3 9	
4th.		
Received in Cash for Bill No. 560, on N. Johnson	£4260 0 0	
5th.		
Accepted a Bill drawn this day by W. Smith and Co., No. 150, payable to J. Masterman and Co. at 4 months	£675 12 0	
6th.		
Received of John Roberts, of Jamaica, the following Remittances in Bills:		
No. 619, dated Aug. 20th, on R. Payne, at 3 months	£200 0 0	
" 620, " " T. Bevan, " "	200 0 0	
" 621, " " N. Allison, " "	200 0 0	
" 622, " Sept. 1st. S. Stone, " "	350 0 0	
" 623, " " B. Hulme, " "	400 0 0	
" 624, " " W. Alexander, " "	570 10 0	
8th.		
Sold per William Knight and Co., at public sale, 7 hhds. of Sugar per the Ballarat, net 78 cwt., at 60s.	£231 0 0	
Due to them for Brokerage at 1 per cent.	2 6 9	
8th.		
Received in Cash for Bill No. 611, J. Harris	£580 0 0	
10th.		
Paid for freight of Coffee per the Wellington	£42 15 0	
11th.		
Received in Cash for Bill No. 561, on W. Benson	£1000 0 0	
12th.		
Paid for duties and fees on Coffee per Wellington	£3 4 6	
12th.		
Accepted a Bill drawn by Schofield, Halse, and Co., of Jamaica, dated 30th July, 1881, No. 151, payable to W. Bright, London, at 90 days' sight	£175 10 0	
14th.		
Paid dock dues, etc., on Coffee, per Wellington	£12 11 1	
15th.		
Received cash for Bill No. 613, on T. Salomons	£100 0 0	
Do. do. " 614, " J. Sidney	120 0 0	
16th.		
Accepted a Bill drawn by Fox, Tennant, and Co., dated Liverpool, 7th Oct., 1881, No. 152, payable to J. Halifax, London, at 15 days' date	£73 15 0	
18th.		
Accepted a Bill drawn by R. Heathfield, on account of T. Ellis and Sons, dated Liverpool, 15th Oct., 1881, No. 153, payable to S. Cattley, London, at one month	£132 10 0	

20th.		
Sold per William Knight and Co., at public sale, 14 tierces of Coffee, per Wellington, Net cwt. 76 : 0 : 22, at 12½s. 6d.	£462 17 9	
Discount 1 per cent.	4 12 7	
21st.		
Received Cash for Bill No. 615, on L. Dixon	£120 7 6	
Do. do. " 616, " W. Turner	170 0 0	
22nd.		
Sold per William Knight and Co., at public sale, 6 tierces of Coffee per Wellington, Net cwt. 32 : 1 : 19, at 120s. per cwt.	£194 9 4	
tierce, net cwt. 4 : 1 : 17, at 117s. per cwt.	25 15 0	
Discount 1 per cent.	2 4 0	
22nd.		
Due to them brokerage on £683 2 1, at 1 per cent.	6 16 7	
22nd.		
Paid Bill No. 152, J. Halifax	£73 15 0	
23rd.		
Paid public sale charges on Coffee per Wellington	£1 7 6	
23rd.		
Received in Cash for Bill No. 617, on B. Hoole	£200 0 0	
Do. do. " 618, " D. Hughes	140 0 0	
Do. do. " 602, " Gibbs and Co.	1500 0 0	
24th.		
Received of Schofield, Halse, and Co., of Jamaica, the following Remittances in Bills:		
No. 625, dated Aug. 4, on R. Kirkman, at 3 months	£200 0 0	
" 626, " " T. Griffiths, " 3	200 0 0	
" 627, " " N. White, " 3	200 0 0	
25th.		
Received of Richard Sykes, of Barbadoes, the following Remittances in Bills:		
No. 628, dated Sept. 6th, on W. Currie, at 3 months	£60 0 0	
" 629, " " J. Overton, " 3	100 0 0	
26th.		
Received from Peter Hutchinson and Co., a Bill drawn by R. Farrar, Belfast, No. 630, dated Oct. 18th, on W. O'Callaghan, Dublin, to the order of S. Richards, at 2 months	£350 0 0	
25th.		
Received from Richard O'Brien and Co., a Bill drawn by D. Anderson, Cork, No. 631, dated Oct. 21st, on T. Charrington, London, to the order of W. Whitmore, at 1 month	£135 0 0	
29th.		
Took out of Cash for Petty Cash	£20 0 0	
November 1st.		
Received from Thomas Brown and Co., a Bill drawn by T. Chandler, Falmouth, No. 632, dated Oct. 21th, on W. Coles, Plymouth, to the order of J. Noyes, at 2 months	£260 0 0	
4th.		
Paid Bill No. 141, Roberts and Co.	£500 0 0	
" 142, Thomas Riley	300 0 0	
4th.		
Received in Cash for Bill No. 610, Kennard and Co.	£1000 0 0	
4th.		
Paid Bill No. 147, J. Wilson	£200 0 0	
" 148, T. Carr	200 0 0	
" 149, S. Curtis	200 0 0	
7th.		
Received in Cash for Bill No. 623, R. Kirkman	£200 0 0	
" " " 626, T. Griffiths	200 0 0	
" " " 627, N. White	200 0 0	
8th.		
Received of William Knight and Co. their proceeds of Sugar, per the Ballarat	£231 0 0	
Paid their Brokerage on ditto	2 6 9	
9th.		
Received in Cash for Bill No. 564, on R. Brett	£980 0 0	
" " " 565, " W. Wragg	630 5 0	
10th.		
Received in Cash for Bill No. 612, W. Melville	£376 15 0	
12th.		
Paid in Cash for Premiums of Insurance due since June last	£1880 15 0	
14th.		
Received for £3,000 of Three per Cents. stock, sold at 95½ per cent.	£2876 5 0	
16th.		
Paid Bill No. 140, R. Hastie and Co.	£60 0 0	

17th.		
Received for Exchequer Bills transferred	£2500 0 0	
15th.		
Paid Bill No. 153, S. Cattley	£132 10 0	
19th.		
Paid Bill No. 144, Barnett and Co.	£200 0 0	
" " 145, Davis and Co.	200 0 0	
22nd.		
Received of W. Knight and Co. their proceeds of Coffee, per the Wellington	£676 5 6	
Paid them for Brokerage on ditto	6 16 7	
23rd.		
Received in Cash for Bill No. 619, R. Payne	£200 0 0	
" " " 620, T. Devan	200 0 0	
" " " 621, N. Allison	200 0 0	
24th.		
Received in Cash for Bill No. 631, T. Charrington	£135 0 0	
24th.		
Made up the account sales of Sugar per the Ballarat, as per A. S. B. fol. 1:—		
The Insurance, etc., being	£6 13 0	
The Brokerage paid Knight and Co.	2 6 9	
The charges for Duty, etc.	137 3 5	
The Commission on £234 at 2 per cent.	4 13 4	
The net proceeds due to Nathan Herschell, Esq.	83 3 6	
30th.		
Made up the account sales of Coffee per the Wellington, as per A. S. B. fol. 2:—		
The Insurance, etc., being	£22 16 9	
The Brokerage paid Knight and Co.	6 16 7	
The charges for Duty, etc.	59 18 1	
The Commission on £676 at 2½ per cent.	16 18 0	
The net proceeds due to John Henderson, Esq.	509 16 1	
30th.		
Took out of Cash for Petty Cash	£10 0 0	
December 1st.		
Received for Drawback on Goods per the Tigris	£215 12 0	
2nd.		
Received from Dawson and Hancock for Scotch Linen	£1750 0 0	
3rd.		
Received for Drawback on Goods per the Racer	£182 0 0	
4th.		
Received in Cash for Bill No. 622, S. Stone	£350 0 0	
" " " 623, B. Hulme	400 0 0	
" " " 624, W. Alexander	576 10 0	
4th.		
Paid Bill No. 143, H. Green and Co.	£600 0 0	
9th.		
Received in Cash for Bill No. 628, W. Currie	£60 0 0	
" " " 629, J. Overton	100 0 0	
10th.		
Received for freight of Goods per the Victoria	£300 0 0	
15th.		
Received for Interest on Exchequer Bills	£500 0 0	
19th.		
Paid Bill No. 146, T. Gurney	£300 0 0	
21st.		
Received in Cash for Bill No. 630, W. O'Callaghan	£350 0 0	
24th.		
Paid Andrew Lloyd balance of account	£116 11 0	
26th.		
Received for Exchequer Bills transferred	£1297 12 6	
26th.		
Received of T. Ellis and Sons	£132 10 0	
26th.		
Paid Samuel Morley balance of account	£960 15 0	
26th.		
Received of Fox, Tennant, and Co. balance of account	£73 15 0	
27th.		
Received in Cash for Bill No. 632, W. Coles	£260 0 0	
27th.		
Paid Thomas Brown and Co. balance of account	£260 0 0	
27th.		
Paid Peter Hutchinson and Co. balance of account	£32 7 6	
28th.		
Received of Richard O'Brien and Co. balance of account	£133 17 0	
30th.		
Took out of Cash for Petty Cash	£20 0 0	
31st.		
Due to Schofield, Halse, and Co. for Interest, less postage, etc.	£18 10 0	
31st.		
Received in Cash for Interest on our deposits	£116 11 3	

LESSONS IN ENGLISH.—XXIX.

LATIN STEMS (continued).

Words are undergoing constant change of signification. The changes are in general so slow as scarcely to be noticeable, except at considerable intervals. There is a certain elasticity of mind which contracts and expands, and expands and contracts. Corresponding with these internal movements is a contraction and expansion of the import of words. The term "import" furnishes an illustration. The import of a word is, according to the etymology of the term, that which the word carries in itself. That something, that load or freight, is a variable quantity; it varies in quality as well as in quantity. The vase swells with its contents, and so its capacity is augmented.

Among the changes which words undergo, two of great importance may be specified: one is a change from good to bad, the other is a change from bad to good. On the former I add a few things here; the latter must stand over for a little space.

Words which originally had a good meaning may degenerate so as to have a bad meaning. *Conventicle* is a harmless word, signifying only a small place of meeting. Our political and religious strifes, however, have thrown around it a feeling of contempt, and in this feeling it is sometimes applied to the chapels of the Nonconformists.

"It behoveth that the place where God shall be served by the whole church be a public place, for the avoiding of privy conventicles, which, covered with pretence of religion, may serve unto dangerous practices."—*Hooker*.

The word *cunning* derivatively denotes knowledge, and the skill that ensues from knowledge. In this sense it was current at the time when our present version of the Scriptures was made; for example—

"If I forget thee, O Jerusalem,

Let my right hand forget her *cunning*."—*Ps. cxxxvii. 5.*

Cunning is of the same origin as *king*, and both denote mental superiority. But, as is exemplified in the slang phrase, "a *knowing* one," knowledge ill-directed may issue in craftiness. The word *craft*, from which the latter is derived, was originally, too, very innocent. Its inoffensiveness is preserved in the term *craft* as applied to a trade:—

"A poem is the work of the poet; poetry is his skill or craft of making."—*Ben Jonson*.

Our *craft* is the Saxon *kraft*, or the German *kraft*, which denotes internal strength, such as comes from essential virtues or from knowledge and skill.

The students of these lessons should always bear in mind how necessary it is for them to acquire facility in composition. They cannot adopt a better plan than that which I have frequently pointed out, namely, to read a passage from some good English author, and then endeavour to reproduce it in writing.

One of the most elegant writers in our language, Mrs. Barbauld, who in her husband's school superintended the lessons in English composition, was accustomed to pursue a plan which to some extent is similar to what I recommend, and which for many years I followed in my own school. Lucy Aikin, her biographer, tells us: "On Wednesdays and Saturdays the boys were called in separate classes to her apartment; she read a fable, a short story, or a moral essay to them aloud, and then sent them back into the school-room to write it out on their slates in their own words. Each exercise was separately looked over by her; the faults of grammar were obliterated, the vulgarisms were chastised, the idle epithets were cancelled, and a distinct reason was always assigned for every correction; so that the arts of editing and of criticising were in some degree learnt together. Many a lad from the great schools, who excels in Latin and Greek, cannot write properly a vernacular (from the Latin *vernaculus*, native) letter, for want of some such discipline."

LATIN STEMS.

Latin Words.	Meanings.	Stems.	English Words.
Curro	I run	cur, curr	incur, curricule, current.
Cursus	a running	curs, curs	excursion, succour.
Datus	given	dat, dat	addition, date, datum, data.
Decor	grace	decor	decorous, decoration.
(decoris)			
Dens (dentis)	a tooth	dent	dentist, indentation.
Dens (dei)	a god	dei	deity, deity.
Dexter	right-handed	dexter	dexterity, dexterous.

Latin Words.	Meanings.	Stems.	English Words.
Dico	I say	dict	dictate, predict, diction.
Dies	a day	di	dial, diary, meridian.
Medius	middle	medi	mediate, mediocrity.
Dignus	worthy	digni	dignity, dignity.
Diurnus	daily	diurn, journ	diurnal, journal.
Doceo	I teach	doc, doct	docile, doctor, doctrine.
Doleo	I grieve	dol	dole, dolorous, condole.
Dominus	a master	domin	domineer, dominion.
Domus	a house	dom	domestic, domicile.
Donum	a gift	don	donation, donor.
Duco	I lead	duc, duct	duct, induce, educate.
Duo	two	du	dual, duel.
Durus	hard	dur	durable, durance.
Ebrius	drunken	ebri	ebriety, inebriate.
Edo	I eat	ed	edible.
Ego	I	ego	egotist, egotism.
Emo	I buy	(e)em, empt	red(e)m, exemption.
Flecto	I bend	flect	reflect, inflect.
Flexus	bent	flez	flexible, flexile.
Flictus (fligo)	dashed	flict	conflict, afflict.
Flos (floris)	a flower	flor	floral, florist.
Fluctus	a wave	fluctu	fluctuate.
Fluo	I flow	flu	fluent, influence.
Fluxus	a flowing	flux	reflux, eflux.
Fœdus (fœderis)	a treaty	feder	federal, confederate.
Foro	I bore, pierce	for	perforate.
Fortis (fortis)	chance	fort	fortuitous, fortunate.
Fortis	strong	forti	fortify, fortitude.
Fossa	a ditch	foss	fossa.
Fossus	dug	foss	fossil.
Frango	I break	frag, fring	fragment, infringe.
Fractus	broken	fract	fracture, fraction.
Frater	a brother	frater, fratri	fraternal, fratricide.
Frigeo	I am cold	frig	frigid, refrigeration.
Fructus	fruit	fructi	fructify.
Frnor	I enjoy	fru	fruition.
Fugio	I fly	fug	refuge, subterfuge.
Fugitum	to fly	fugit	fugitive.
Fulmen (fulminis)	lightning	fulmin	fulminate.
Fundo	I pour	fund	refund.
Fusus	poured	fus	fusible, infuse, refuse.
Gelu	frost	gel, geal, gelat	congeal, congelation, gelatin.
Gens (gentis)	a nation	gent	gentile, gentel.
Genu	a knee	genu	genuflexion.
Gero	I carry	ger, gest	belligerent, gesture, digestion.
Exter	outward	exter	external, exterior.
Faber	a workman	fabr	fabric, fabricate.
Facilis	easy	facil, faeul, fœul	facilitate, faculty.
Facio	I make	fact, fact, fit, fic, fy	factor, perfect, benefit, saporific, purify, saporiferous.
Sopor(soporis)	heaviness, sleep	soyor	fallacious, infallible.
Fallo	I deceive	fall	profane, profanation.
Fanum	a temple	fan	fable, infallible.
Fari	to speak	fa	fate, fatal.
Fatus	spoken	fat	felicity.
Felix (felicitas)	happy	folio	feminine, efeminacy.
Femina	a woman	femin	ferry, infer, circumference.
Fero	I bear	fer	fervid, effervescence.
Ferveo	I boil	ferv	fidelity, infidel.
Fidelis	faithful	fidel	confide, diffidence.
Fido	I trust	fid	
Filia	a daughter	filii	filial, affiliate.
Filius	a son		
Filum	a thread	fil	filament.
Fingo	I feign	fig	figment.
Fictus	feigned	fict	fiction, fictitious.
Finis	an end	fin	final, finite, definite, definitive.
Fiscus	the treasury	fisc	fiscal, confiscate.
Fissus	cleft	fiss	fissure.
Flatus	a puff of wind	flat	flatulent, inflate.

"Modern languages have only one variation, and so the Latin; but the Greek and Hebrew have one to signify two, and another to signify more than two; under one variation (the former) the noun is said to be of the dual number, and under the other of the plural."—*Clarke, "Latin Grammar."*

"A duel, called by the Greeks monomachia (single-fight), and by the Latins duellum, receiving its denomination from the persons engaged in it, is properly a fight or combat between two persons."—*South.*

"I suppose I need not take any pains to prove the unlawfulness, nay the sottishness of such duellings, when men sold their lives for a crown or an angel; and by a preposterous way of labouring not to get their living, but to procure their death."—*South.*

"There is one kind of egotist which is very common in the world. I mean those empty, conceited fellows, who repeat as sayings of their own, or some of their particular friends, several jests which were made before they were born, and which every one who has conversed in the world has heard a hundred times over."—*Spectator.*

"If a pawnbroker receives plate or jewels as a pledge or security for the repayment of money lent thereon, on a day certain, he has them upon an express contract or condition to restore them, if the pledger performs his part by redeeming them in due time."—*Blackstone.*

"A just, though terrible, judgment of God upon these play-hunters and profaners of his holy day."—*Prynne.*

"Somewhat allied to this (blasphemy), though in an inferior degree, is the offence of profane and common swearing."—*Blackstone.*

"When one tossed his weaver's beam, and the other carried the gates of Gaza, they performed their prodigious feats by tender filaments, slighter than a cobweb, undiscernible with a microscope."—*Search, "Light of Nature."*

Definite and definitive are synonymous, that is, words which come near in meaning to each other; I say near in meaning, for there are few pairs of words that have exactly the same force.

Definite and definitive, as coming from finis, an end, agree in that they both put an end to a matter: a definite answer puts an end to your question by speaking so clearly, and so exactly, as to leave no room for its repetition; but a definitive answer puts an end to the matter in issue as well as to the question.

By a definite answer I leave you in no doubt as to my meaning; and by a definitive answer I put a negative on your proposal.

Honest men, and clear-minded men give definite answers; men who have come to a final conclusion pronounce a definitive judgment.

"They never have suffered, and never will suffer, the fixed estate of the church to be converted into a pension, to depend on the treasury, and to be delayed, withheld, or perhaps to be extinguished, by fiscal difficulties."—*Burke, "French Revolution."*

"And all their lands, goods, and possessions were confiscated and seized to ye king's use (use)."—*Hall, "Richard III."*

"There are other subterraneous juts and channels, fissures and passages through which many times the waters make their way."—*Derham, "Physico-Theology."*

To refuse comes immediately from the French *refuser*. But whence the French? From *refutare*, says Richardson; and certainly *refutare*, both in good and in middle-aged Latin, primarily signifies to put down, put back, refuse, and only derivatively to prove logically wrong. But this view makes to refuse and to refute the same in origin. Besides, the *t* and *s* are not interchangeable. It seems less incorrect to derive *refuse* from *re* and *fundo* (*fusus*, *fusion*), which thus means a pouring or handing back.

Refuse, the noun, signifying rubbish, comes from the same root, only it takes its special import from a custom which prevailed in some cathedral and collegiate churches, according to which those who held the benefices were required to put together every year into a common treasury, for the common use, some portion of their income. That portion was seldom the best, and hence the *refusio*, as the Latin name for the common contribution was; *refuse* in English, came to have a bad character, and to be nearly equivalent to our *rubbish*. Rubbish, or in an older form of the word, *rubble*, is that which was rubbed off (Latin, *detritus*), as refuse is that which is poured or thrown back.

EXERCISES IN COMPOSITION.

Historical Theme: "The Mission of Moses to Pharaoh."

WORDS WITH THEIR PROPER PREPOSITIONS.

Words.	Foreign Representatives.
Compelled to,	pello, I drive.
Compliance with,	plica, a fold.
Composed of,	compono, I place together.
Concede to,	cedo, I yield.
Conceive of,	concipio, I take together.
Concerned at, for,	concerno, to regard.
Concur with, in,	curro, I run.
Condemn to,	damnam, injury.
Condescend to,	descendo, I go down.
Conduce to,	duco, I lead.
Confer on,	fero, I bear.

Study and endeavour to reproduce the following gem from the German of Krummacker:—

THE SEVEN CHILDREN.

Early in the morning, as the day began to dawn, the devout father of a family arose with his wife from the couch, and thanked God for the day, and for their refreshing slumber.

But the glow of morning beamed into the little chamber where their seven children lay in their beds asleep.

Then they gazed at the children one by one, and the mother said, "They are seven in number; alas! it will be hard for us to find them food." Thus sighed the mother, for there was a famine in the land.

But the father smiled, and said, "See, do they not lie there, all the seven? And they have all red cheeks, and the beams of the morning stream over them, so that they appear lovelier than ever, like seven blooming roses. Mother, that shows us that He who creates the morning and sends us sleep, is true and unchangeable."

As they stepped from the chamber, they saw at the door fourteen shoes in a row, growing smaller and smaller, two by two, a pair for each child. The mother gazed at them, and when she saw that they were so many, she wept.

But the father said, "Mother, why dost thou weep? Have not all the seven received sound and active feet? Why, then, should we be anxious about that which covers them? If the children have confidence in us, should we not have confidence in Him who can do more than we can comprehend?"

"See, his sun rises! Come, then, like it let us begin our day's work with a cheerful countenance."

Thus they spoke and toiled at their labours, and God blessed the work of their hands, and they had enough and to spare, they and their seven children; for faith gives strength and courage, and love elevates the soul.

LESSONS IN BOTANY.—XXIX.

SECTION LXVI.—HAMAMELIDACEÆ, OR WITCH-HAZELS.

Characteristics: Calyx tubular, adherent to the ovary; limb four to five partite; petals absent, or inserted upon the calyx, and alternating with its divisions; stamens indefinite in the apetalous genera, in the petaliferous genera double the number of the petals, some sterile, and opposite to the petals, others fertile and alternate; anthers square or semi-circular; ovary half inferior, two-celled, cells uni- or multi-ovulate; ovules pendent, reflexed; two styles, two stigmata, both distinct; capsule septicidal, having one-seeded cells.

The members of this natural order are trees or shrubs, ordinarily covered with hair arranged in the form of stars. Leaves alternate, petiolate, simple, bi-stipulate. Flowers almost sessile, disposed in panicles, capitula, or spikes, often monocious.

The few species composing this natural order are dispersed over North America, Japan, China, India, Madagascar, and the Cape. The Virginian hamamelis (*Hamamelis Virginica*) is a shrub having yellow fasciculated flowers, the ovary of which does not ripen until the second year. It is cultivated in gardens for the sake of its oily farinaceous seeds; the decoction of its bark and leaves is charged with tannic bitter principles and a peculiar volatile oil. The alder-leaved fothergillia (*Fothergillia alnifolia*) is a shrub, a native of Carolina, but cultivated in Europe. Its inflorescence is a spike composed of white and odoriferous flowers. Its fruits discharge their seeds with a considerable noise. The *Rhodoleia Championi* (Fig. 218) is a small tree discovered in China by Captain Champion, in the forests which surround Canton. It is cultivated with facility in the open air of European countries. The leaves of this tree are persistent, its flowers grouped in five, are surrounded with roscate bracts, which might be almost taken for a petaloid floral envelope.

SECTION LXVII.—PHILADELPHACEÆ, OR SYRINGAS.

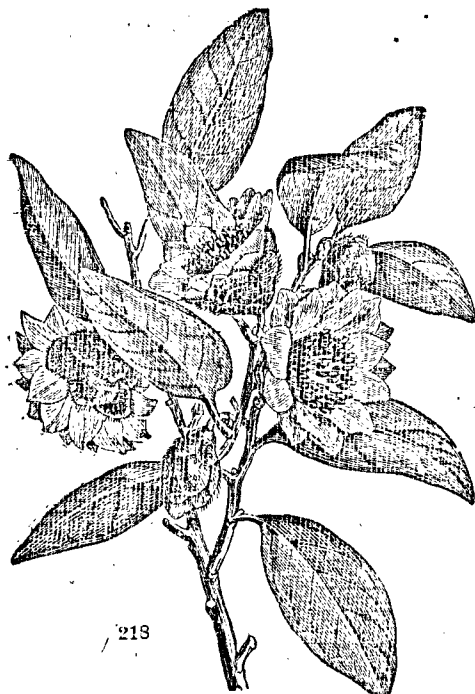
Characteristics: Calyx adherent to the ovary, valvate in aestivation; petals equal in number to the divisions of the calyx, with contorted aestivation; stamens, a multiple number of that of the petals; ovary, three or many celled; placenta central, multi-ovulate; ovules pendent, imbricate, reflexed; capsule, four to ten-celled, many seeded; seeds enveloped in a loose testa; embryo dicotyledonous, straight, in the axis of a fleshy albumen, the length of which it equals. The members of this natural order are shrubs, having simple opposite leaves without stipules. Their flowers are complete, regular, white, odoriferous, disposed either in cymes or panicles.

The *Philadelphus coronarius*, or garland syringa (Fig. 220), is indigenous to Central Europe, and a frequent garden ornament. Its flowers are very odorous, and were formerly held in esteem as a medicine. They contain a volatile oil sometimes employed as an agent for the adulteration of oil of jasmine. The *Deutzia scabra*, or rough-leaved deutzia, is a native of Japan, now cultivated in botanic gardens. The Japanese employ the inner bark of this tree as a plaster; its leaves are employed to impart a polish to wood.

SECTION LXVIII.—CEPHALOTACEÆ.

The genus *Cephalotus*, which Labillardiere placed amongst the *Rosaceæ*, and which other authors have annexed to the *Saxifragæ*, is considered by Dr. Lindley as being likely to be ultimately classed by botanists as a sub-family of the natural order *Ranunculaceæ*, or *Crowfoots*.

It is constituted by certain perennial plants of Australia, having a short subterranean stem, and leaves united in a tuft, and offering two distinct forms; one form plane, oval oblong, the other situated a little below the preceding, composed of a petiole dilated into a pair of labiate expansions, the lower one being large, hollowed out like a cup, the upper one smaller, flat, and serving as a cover. The flowers are white and small; the calyx is free, six-partite, petaloid, valvate in æstivation, corolla absent. The twelve stamens are inserted upon the border of the tube of the calyx. The six ovaries are sessile upon a plane receptacle, alternate with the sepals, uni-locular, uni- or bi-ovulate. Ovules erect, reflexed. Fruit composed of six achenia,

218. CHAMPION'S RHODOLEIA (*RHODOLEIA CHAMPIONI*).

which open on their inner edge. Cotyledon small, straight, at the base of a fleshy albumen. One species, the *Cephalotus follicularis*, or New Holland pitcher plant (Fig. 225, 226), has been some years introduced into European gardens.

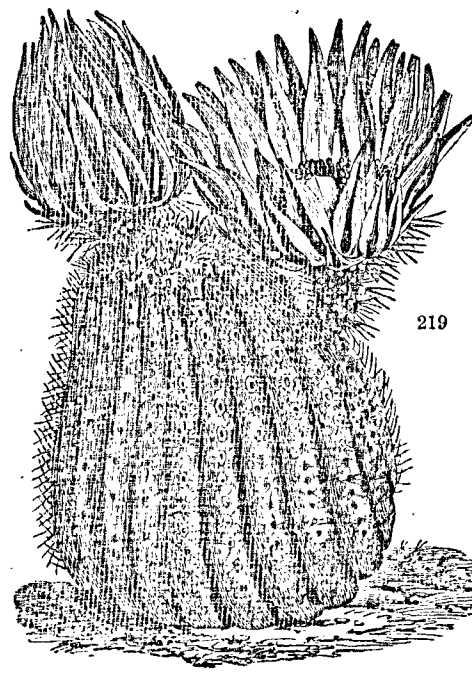
SECTION LXIX.—CRASSULACEÆ, OR HOUSE-LEEKS.

Characteristics: Sepals free; petals in number equal to them, free or coherent at the base, imbricated in æstivation; stamens inserted with the petals and ordinarily adherent to them; their number equal to or double that of the petals; carpels free or attached to an axis, each furnished with a scale at its base, and pluri-ovulate; ovules horizontal or pendent; follicles ordinarily free; dehiscence ventral, sometimes combined into a capsule, in which case the dehiscence is dorsal; embryo dicotyledonous, straight, occupying the axis of a small fleshy albumen.

The *Crassulaceæ* are in some cases subligneous herbs, more or less charged with juicy matter; leaves ordinarily simple, deprived of stipules; flowers terminal, corymbose, or in cymes, or agglomerated, occasionally solitary (Fig. 221, 224).

The *Crassulaceæ* grow in the warmer parts of the temperate regions of the Eastern Hemisphere. They thrive in the most

arid soils, and remain fresh by reason of the humidity they absorb from the air as well as the soil. Nearly all the moisture thus absorbed is retained, because the surface of these plants allows but little transudation, very few stomata or evaporating pores existing in its structure. All the *Crassulaceæ* abound in a slightly saline aqueous juice containing malic acid. On account of these constituents, the *Crassulaceæ* have acquired some celebrity as medicinal agents. A few species are edible. The purple stonecrop (*Sedum Telephium*), the white stonecrop (*Sedum album*), and the yellow stonecrop (*Sedum reflexum*), as well as the house-leek (*Sedum sempervivum*), are frequently employed for stimulating wounds; the Mediterranean *Crassulæ* possess similar qualities. The acrid stonecrop (*Sedum acre*), a plant which grows in sunny places in England, contains an acrid principle, in virtue of which it is rubefacient, or causes a redness of the skin when externally applied, purgative and emetic when administered internally. The root of the rose-scented stonecrop (*Sedum Rhodiola*), so called from the circumstance of its diffusing an odour similar to that of a rose, was

219. COMB-BEARING HEDGEHOG THISTLE (*ECHINOCACTUS PECTINIFERUS*).

formerly used by medical practitioners and herbalists as a sedative. The Greenlanders boil this vegetable, and eat it as a pot-herb.

The leaves of *Bryophyllum calycinum*, a species of house-leek, a native of the East Indies, present a very curious physiological phenomenon, the germs of this plant growing at the extremity of the leaf-nerves. A single leaf laid on a damp surface will throw out young plants all round its margin.

SECTION LXX.—MESEMBRYACEÆ, OR FICOIDS.

Characteristics: Tubular calyx consolidated with the ovary; petals indefinite, inserted on the calyx; ovary many-celled, placenta applied to the midrib of the carpels or axile; ovules numerous, curved; stigmas sessile; capsule multi-valvular; seed dicotyledonous; embryo surrounding a farinaceous albumen.

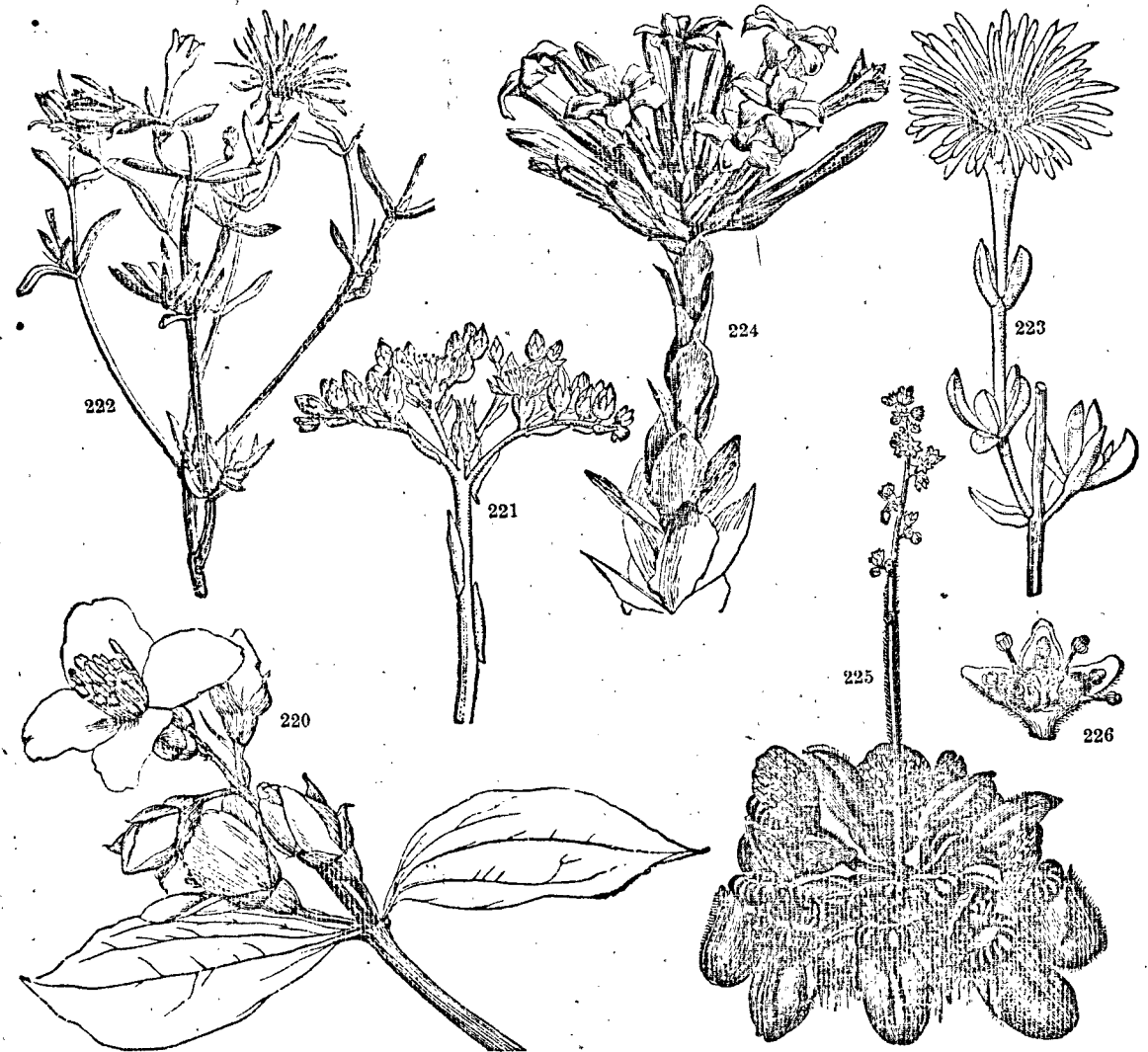
The members of this natural order are herbs or small shrubs, and are chiefly natives of the Cape of Good Hope. Their leaves are fleshy, their flowers axillary or terminal, solitary, or disposed in the form of a cymose corymb. Capsule at first fleshy, then almost woody; opening in a stellate manner. Epicarp thick and coriaceous, separated from the endocarp, which latter is

persistent under the form of double membranous triangular leaf-like appendages.

Many species of this natural order are cultivated for the beauty of their flowers; some, too, are useful. The succulent leaves contain many salts, especially oxalate of lime; some are sapid and saccharine. The ice-plant (*Mesembryanthemum crystallinum*), which is a very common growth in the Canary Islands and the Mediterranean region, is charged with gelatinous

below, and thus forming an elongated tube; stamens numerous, multi-serial, inserted upon the base of the corolla; ovary inferior, unilocular; placenta parietal, multi-ovular; berry pulpy; seeds numerous, dicotyledonous; embryo straight or curved; albumen absent or scarcely visible.

The *Cactaceæ* are American plants; they are ligneous and fleshy; their stem is branched or simple by the suppression of buds; cylindrical, fluted, flat, or globular (Fig. 219), covered



220. THE GARLAND SYRINGA (*PHILADELPHUS CORONARIUS*). 221. STONECROP (*SEDUM*). 222. PURPLE MESEMBRYANTHEMUM (*MESEMBRYANTHEMUM FULGIDUM*). 223. SICKLE-SHAPED MESEMBRYANTHEMUM (*MESEMBRYANTHEMUM FALCIFORME*). 224. SCARLET CRASSULA (*CRASSULA COCCINEA*). 225. NEW HOLLAND PITCHER PLANT (*CEPHALOTUS FOLLICULARIS*). 226. BLOSSOM OF NEW HOLLAND PITCHER PLANT.

vesicles, which cause it to appear, when shining in the sun's rays, as if covered with a crest of hoar-frost. The inhabitants of the Canary Islands burn this plant for the purpose of extracting soda from its ashes. The fruit of the Hottentot fig-marigold (*Mesembryanthemum edule*) is eaten as food by the Hottentots. *Mesembryanthemum fulgidum* is a favourite object of culture on account of the extreme beauty of its deep purple flowers (Fig. 222). Another species is figured in Fig. 223.

SECTION LXXI.—CACTACEÆ, OR INDIAN FIGS.

Characteristics: Calyx adherent to the ovary; with pluri-serial, petaloid limb, indistinguishable from the corolla; petals numerous, pluri-serial, imbricated in æstivation, inserted upon the summit of the calycinal tube, sometimes free, sometimes coherent

with test-like tubercles, the representatives of abortive branches. The leaves are generally absent, or at most indicated by a small cushion-like excrescence lying beneath a bud; sometimes perfect, plane and petiolate, as in the case of *Pereskia*, the Barbadoes gooseberry; the buds situated in the axilla of the abortive leaves are of two orders, the inferior ones are covered with spines, whilst the superior ones are developed in branches or in flowers.

The berries of many of the Cactus tribe are employed in medicine as a remedy for bilious affections. The *Opuntia vulgaris*, or prickly pear, has long been naturalised in the Mediterranean regions; also the Nopal plant, or *Opuntia cochinellifera*. Upon these plants thrive the valuable cochineal insect, from which carmine and carmine lake are extracted.

LESSONS IN GERMAN.—XXXIX.

SECTION LXXVIII.—VARIOUS IDIOMATIC PHRASES
(continued).

Der Schlag, "the blow, the stroke" (commonly connected with rüßren), often denotes palsy, apoplexy; as:—Er ist von dem Schlag gerührt worden, he has been struck with the palsy. Er hatte einen Anfall vom Schlag, he had an apoplectic fit.

1. Abgehen = to go away, to leave; as:—Der Zug ist schon abgegangen, the train has already left (started). Es geht gut ab = it sells well; as:—Der Wein geht gut ab, the wine sells well (goes off well).

2. Er läßt sich nichts abgehen = he lets nothing (advantageous) go from him, that is, he stints himself in nothing.

3. Je nachdem = ever after, or according as; as:—Je nachdem ich Muße habe, werde ich Sie besuchen, as, or according as I have leisure I will visit you, etc.

4. Einfallen signifies literally, to fall in, or into; hence, to fall down, or to ruin, to decay, etc. With the dative it signifies, to come into the mind, to occur; as:—Es ist mir nie eingefallen, so etwas zu thun, it never occurred to me to do such a thing.

5. So fern, or in so fern = in so far as, if, in case; as:—Ich erlaube es dir, in so fern es von mir abhängt, I will permit it, so far as it depends upon me. In so fern es die Zeit erlaubt, if, or in case the time permit, etc.

6. Angehen, used intransitively, signifies, to begin; as:—Der Gottesdienst in Deutschland geht gewöhnlich des Morgens um neun Uhr an, the church-service in Germany generally commences in the morning at nine o'clock. Used transitively, it signifies, "to concern, to be of consequence;" as:—Das geht ihn an, that is his concern, or that concerns him. Das geht mich nichts an, that does not concern me (is of no consequence to me).

VOCABULARY.

Abgang, m. sale, market ("run").	In so fern. (See 5, above.)	Sinn, m. mind, sense.
Abkühlen, to cool.	Rümmern, to concern, trouble.	Sitzung, f. session, sitting.
Angehen. (See 6, above.)	Erträglich, tolerable, supportable.	Un'erträglich, unsociable, intolerant.
Debatte, f. debate.	Nach, wet.	Vorsicht, f. precaution.
Einfall, m. idea, thought.	Nach, quick, swift.	
Einfallen, to fall in, occur.	Schlag, m. (See above.)	Zunehmen, to increase.
Erkalten, to take cold.	Schnupfen, m. cold (in the head).	Zusammenfallen, to tumble, to fall together, to fall to ruin.
Gelaunt, disposed, humoured.		

RÉSUMÉ OF EXAMPLES.

Der Schlag rührte ihn auf der linken Seite.	The palsy struck him on the left side.
Er kam ta wie vom Schlag ge-rührt.	He stood there as if struck with the palsy.
Wo ging der Streit an?	Where did the contest begin?
Was geht mich deine Freuden an?	How do thy pleasures concern me?
Das Dampfschiff geht um vier Uhr ab.	The steam-boat leaves at four o'clock.
Diese Waare geht gut ab.	This ware sells well. (See 1.)
Dieser Mann läßt sich nichts abgehen.	This man does not stint himself. (See 2.)
Die Unterredung ging ruhig ab.	The conference passed off quietly.
Je nachdem die Unterhaltung ist, ist auch die Stimmung.	According as the entertainment is, so also is the humour.
In so fern Du Recht hast, werde ich Dir nachgeben.	As far as you are right, I will yield to you.

EXERCISE 150.

1. Mein kleiner Bruder hat den Schnupfen; er hat sich auf dem Gise fast erkältet. 2. Wer erbt ist und sich zu rasch abkühlt, kann sich leicht erkälten. 3. Wir sollen uns nicht um Dinge kümmern, welche uns nichts angehen. 4. In so weit mich diese Sache angeht, habe ich die nöthigen Schritte gethan. 5. Dieses geht Euch nichts an. 6. Bei dieser Kunte stand er wie vom Schlag gerührt. 7. Den alten Mann hat der Schlag gerührt. 8. Der Mann ist vom Schlag gerührt worden. 9. Die vom Schlag gerührt sind sie nicht. 10. Diese Waare geht gut ab. 11. Wann geht das nächste Dampfschiff ab? 12. Ich sehe nicht, daß sich dieser Mann etwas abgehen läßt. 13. Ist die Sitzung ruhig abgegangen? 14. Mein, sie ist nicht ruhig abgegangen—die Debatte war sehr stürmisch.

15. Dieses Buch hatte einen starken Abgang. 16. Der junge Kaufmann erzählt mir, daß der Abgang bedeutend zugenommen habe. 17. Je nachdem es mir in den Sinn kommt, reise ich von hier ab. 18. Je nachdem er gelaunt ist, kann er der herzlichste, aber auch der unverträglichste Mensch sein. 19. Je nachdem er es anfängt, wird der Erfolg sein. 20. In so fern ich Dir nützlich sein kann, will ich es von Herzen gern thun. 21. Er wird mich mit seinem Rath unterstützen, in so fern es ihm möglich ist. 22. Sein Vater versprach mir die Sache zu befördern, in so fern es in seiner Macht läge. 23. So etwas ist mir nie eingefallen. 24. Das Concert geht um halb sieben an. 25. Mein Freund hatte einen herrlichen Einfall. 26. Es ist bei dem schließlichen Deutsch ein Einfall schöner als der andere. 27. Auf die Frage, was ein Einfall wäre, antwortete Einer: „wenn ein Haus einfällt.“

EXERCISE 151.

1. My sister has a cold; she took cold one wet evening. 2. That case does not concern me, and therefore I shall not trouble myself about it. 3. Has the train already left? 4. No, it has not left yet. 5. Has the train left for Oxford? 6. Two trains have already left this morning for Oxford. 7. Did the debate pass off quietly? 8. No, it was a very stormy one. 9. English goods sell well in every country. 10. This grammar has a great sale. 11. According to your knowledge you will be rewarded. 12. Since he has been struck with the palsy, he has not been able to attend to his business. 13. He was struck with the palsy during our visit to your house. 14. As far as it concerns me, I shall take every precaution. 15. In spite of their poverty, these people stint themselves in nothing. 16. To mankind nothing is better than a good education. 17. I do not know whether he will grant my request.

SECTION LXXIX.—VARIOUS IDIOMATIC PHRASES

(continued).

The obsolete word *lei* (sort, kind) still remains in combination with the numerals, forming what are called the *variatives*; thus, *Einlei*, of one kind, the same; *Dreilei*, of three kinds (§ 48); as:—*Dreilei* bringe ich zu dir, erwähle dir eines, three (sorts of) things I bring (to) thee, choose thee one. Es ist ihm einerlei, or eins, ob er geht, oder bleibt, it is the same to him whether he goes or stays. 1. *Sehen*, with the preposition *über*, is often used with the signification "to transcend, to surpass;" as:—*Zufriedenheit* geht über *Reichthum*, contentment surpasses wealth.

VOCABULARY.

Begünstigen, to favour	Gymnasium, n. gymnasium, classical school.	Stück, n. piece.
Bonn, n. Bonn.	nasium, classical school.	Tisch, m. pond.
Einlei, of one kind, the same.	Schul, n. school.	Trägheit, f. idleness.
Erziehung, f. bringing up, education.	Seilsam, beneficial.	Umgebung, f. neighbourhood, environs.
Ente, f. duck.	Lügner, m. liar.	Un'bestimmt, unconcerned, careless.
Entsagen, to renounce.	Nachtheil, m. disadvantage.	Universität, f. university.
Funkeln, n. sparklet.	Mutlos, useless.	Verhältniß, n. relation, circumstance, situation.
Gang, m. direction, course.	Menschenfresser, n. mankind.	Witzpret, n. venison.
Geduldig, patiently.	Pfeifen, n. little pipe.	Wohlfahrt, f. welfare.
Gefühl, n. touch.	Rinderbraten, n. beef.	Zuführen, to pass, spend.
Geschäft, n. affair, business.	Schatz, m. treasure.	
	Schlafen, to sleep.	
	Schuligkeit, f. obligation, duty.	

RÉSUMÉ OF EXAMPLES.

Wie es dem Vogel nicht einerlei ist, ob er sich in dem Käfige, oder in der freien Luft befindet, so darf es einem Volke auch nicht eins sein, ob es in Sklaverei, oder in Freiheit ist. Dies geht mir über Alles. Dem Aufrichtigen geht nichts über die Wahrheit. Manchen Menschen geht nichts über Bequemlichkeit und Ruhe. Wir gingen über Moskau nach Petersburg. Der Feind ging bei Wien über die Donau. Es ist unrecht, die Zeit seines Lebens in Abgeschlossenheit von den übrigen Menschen zuzubringen. As it is not the same to the bird, whether it is (in) the cage or in the open air, so likewise can it not be the same to a nation, whether it is in slavery or in freedom. This with me excels everything. To the upright nothing is better than the truth. With many persons, nothing goes beyond convenience and repose. We went by way of Moscow to Petersburg. The enemy went over the Danube at Vienna. It is wrong to pass one's life in seclusion from the rest of mankind.

EXERCISE 152.

1. Er bringt seine Zeit mit Nüchternheit zu (§ 93. 2). 2. Er brachte den größten Theil seiner Jugend auf den Gymnasien (§ 19) und Universitäten seines Landes zu. 3. Die meiste Zeit bringt er mit nutzlosen Beschäftigungen zu. 4. Viele Menschen bringen ihre Zeit mit Essen, Trinken und Schlafen zu. 5. Einem jeden Menschen, der nur ein künftiges Gefühl hat, geht nichts über sein Vaterland und über die Wohlfahrt desselben. 6. Es geht nichts über die Ruhe der Seele, und das Verachtsein, seine Schuldigkeit gethan zu haben. 7. Er sagte, seine größte Freude und sein größter Schatz seien seine Kinder, und nichts gehe ihm über dieselben. 8. Ein Matrose sagte, es gehe ihm nichts über ein Pfeifen. 9. Dem Gleichgültigen ist zwar Vieles einerlei; aber er sagt, es sei ihm Alles einerlei, ist ein Lügner. 10. Was man versprochen hat, soll man halten, einerlei, ob Nachtheil oder Vortheil daraus entsteht. 11. Dem Soldaten muß im Kriege Alles eins sein. 12. Ein rechter Mann schied sich getrost in alle Verhältnisse; es ist ihm Alles eins, was er thut, nicht aber, wie er es thut. 13. Seit dem Tode seiner Mutter ist ihm Alles eins; er ist gleichgültig gegen seine Umgebung, und unbethümt um den Gang seiner Geschäfte. 14. Ein jeder Mensch hat seinen freien Willen; deshalb geht es mich nichts an, wie er seine Zeit verwenet. 15. Ich reise über Rotterdam und London nach Amerika. 16. Der Freund ging stehen über die Straße. 17. Der arme Knabe dankte ihn, deshalb nahm er ihn zu sich in sein Haus, und ließ ihm eine ordentliche Erziehung geben. 18. Den das Vieh nicht tauert, und wer unfarmherzig gegen dasselbe ist, den tauert auch ein Mensch nicht.

EXERCISE 153.

1. Many people pass their time in idleness. 2. He spent the greatest part of his life in foreign countries. 3. Any man who has a touch of honour, renounces no duties which will benefit mankind. 4. He says his greatest treasure was God, and the whole world is as nothing compared to Him. 5. This man said, it were all the same to him whether his undertakings were successful or not. 6. How many sorts of wine have you? 7. I have three sorts, you may choose which you like. 8. I go every day twice over London Bridge. 9. Many go to Germany by way of Ostend. 10. I shall probably spend one month in Bonn. 11. My neighbour has three different kinds of ducks in his pond; they are very beautiful. 12. We have three sorts of roses growing in our garden. 13. When I am hungry, it is the same to me whether I have venison or a piece of beef before me. 14. He bought ribbons of three sorts of colours.

SECTION LXXX.—VARIOUS IDIOMATIC PHRASES

(continued).

Verlassen, when used reflexively, signifies, "to depend upon, to rely upon;" as:—Ich verlässe mich auf Ihr Wort, I depend upon your word (I leave myself upon your word).

1. Abhängen, likewise, signifies, "to depend upon, to be dependent upon;" as:—Es hängt von Umständen ab, it depends upon circumstances. Thence is derived the adjective *abhängig*, dependent; as:—Er führt ein abhängiges Leben, he leads a dependent life. Die Vereinigten Staaten erklärten sich als ein unabhängiges Volk, the United States declared themselves (as) an independent people.

VOCABULARY.

Abhängen. (See 1, above.)	Frucht, f. fruit.	Kanarienvogel, m. canary-bird.
Abhängig, dependent.	Gefahren, to behave.	Offnen, to open.
Bedingung, f. condition, stipulation.	Gemächlich, comfortable, easy.	Umfang, m. circumstance.
Darinnwilligen, to consent.	Gerecht, exactly.	Unabhängig, independent.
Entzweit, to fall out, disunite, quarrel.	Gelingen, to turn out, succeed.	Verdächtig, to disown, despise.
Fähigkeit, f. ability.	Sinaus, out, out there.	Wohlmein, to mean well, wish well.
Folge, f. sequel, consequence.	Sinauswerfen, to throw out.	Zufällig, obtrusive.

RÉSUMÉ OF EXAMPLES.

Ich kann nicht darinnwilligen. He agreed (consented) to it hesitatingly. Diese Leute stellen sich, als ob sie von Sinnen wären. These people act (place themselves) as if they were out of their senses. Es widerfährt uns in unserm Leben (§ 15. 2. d.) manches Glück und manches Unglück. There happens to us in our lives (many a) much happiness and many a misfortune.

Es widerfährt Manchem mehr Ehre, als er verdient. There happens to many a one more honour than he deserves.

Der Vogel ist zum Fenster hinaus' geflogen. The bird has flown out of the window.

Die Freunde entzweit'en sich. The friends quarrelled (separated themselves).

Die Pflaume ist ein Steinobst. (The) plums are a stone fruit. Sie verließen sich darauf, daß er sein Versprechen halten würde. They relied upon his keeping his promise.

Man soll nie eher in eine Sache einwilligen, als bis man dieselbe wohl überlegt hat. One should never assent to a thing before one has well considered it (the same).

Ist es nicht, als ob dieses Volk mich zum Götze mache? (Schiller.) Is it not as though this people would make me a God?

EXERCISE 154.

1. Dieses Jahr ist das Obst, sowie alle Früchte, wohl geathen. 2. Dieser Baum trägt jedes Jahr sehr viele Früchte. 3. Sind alle Früchte Obst? 4. Nein, nicht alle, sondern nur solche, die (§ 65. 2) an Bäumen wachsen. 5. Dieser junge Mann verläßt sich zu viel auf seine Verwandten und zu wenig auf seine eigenen Fähigkeiten. 6. Er verläßt sich darauf, daß wir ihn die nächste Woche besuchen. 7. Er verließ sich darauf, daß ihm Gott helfen werde. 8. Wer sich zu viel auf Andere verläßt, kann leicht getäuscht werden. 9. Ich hatte (Sect. LXXVIII. 2) viel auf meine Freunde. 10. Er hält viel auf ein gemischtes Leben. 11. Dieser Mann hält zu viel von sich und seiner Klugheit, weshalb er den Rath wohlmeinender Freunde verachtet. 12. Nur unter tiefer Betrügnung kann ich darinnwilligen. 13. Ich willige darinn, in so fern (Sect. LXXVIII. 5) es keine üblen Folgen hat. 14. Er willigte darinn, ohne mit allen Schwierigkeiten bekannt zu sein. 15. Dieses Kind that gerade, als ob es hier zu Hause wäre. 16. Der Matrose stellte sich, als ob er von Sinnen wäre. 17. Er gefordert sich, als ob ihm das größte Unrecht widerfahren wäre. 18. Dieser Mann stellt sich, als ob er beleidigt wäre. 19. Er stellt sich wie ein Kind von fünf Jahren. 20. Der Nachbar warf den Zutrittlichen zur Thüre hinaus. 21. Der Knabe eilte zur Thüre hinaus, als ich dieselbe öffnete. 22. Zur Thüre hinaus, wer sich entzweit! (Göthe.) 23. Es hängt ganz von den Umständen ab, ob ich schon nächstes Jahr nach Amerika reise oder nicht. 24. Es hängt sehr von den Umständen ab, was er thun wird. 25. Ein so abhängiges Leben wie Bauern in Deutschland führen, ein eben so unabhängiges führen sie in Amerika. 26. Ganz unabhängig vermag kein Mensch auf Erden zu werden.

EXERCISE 155.

1. Last year the fruit did not turn out well. 2. This tree yield fruits but seldom. 3. This young gentleman relies too much upon his abilities. 4. No, he does not rely too much upon his abilities, but he knows it is not well to be dependent upon those of others. 5. I rely upon you that you will visit me next week. 6. Do exactly as if you were at home. 7. The criminal acted as if he were out of his senses. 8. This man acts exactly as a child. 9. Where is your canary-bird? It is flown out of the window. 10. How can I assent to a thing which is against my inclination? 11. Whoever quarrels shall be expelled the house. 12. It depends upon circumstances whether I shall go to my friends. 13. Every man strives to be independent. 14. Depend upon it that I shall not help you again.

KEY TO EXERCISES IN LESSONS IN GERMAN.

EXERCISE 104 (Vol. II., page 155).

1. For this reason I left my fatherland. 2. He had saved nothing except his bare life. 3. Several soldiers lost their lives in the battle. 4. Our troops advanced towards the enemy. 5. Opposite, the friend sat the preacher. 6. The confederates came together in the night upon the Rutil, conformably to agreement. 7. After the fall of Carthage, the Roman empire hastened more and more towards its dissolution. 8. Next to the general comes the colonel. 9. I have invited Mr. N. with his children to dinner. 10. We shall visit you, with our friend, the first opportunity. 11. The Indian goes a-hunting with bow and arrow. 12. There have not been similar scenes since the Thirty Years' War. 13. You may ask everything of me. 14. Looking towards heaven, the sick man expired. 15. Next to him stood the king. 16. Against the wish of his father he entered the army.

EXERCISE 105 (Vol. II., page 155).

1. Ich fahre fort, gemäß meiner frühern Gewohnheit. 2. Mein Freund ging meinem Götze entgegen. 3. Mir gegenüber saß meine Mutter, neben meinem Oheim. 4. Ich ritt durch den Park. 5. Er trägt nach meiner Schwester. 6. Seit ich dort war, habe ich nichts mehr von der Sache gehört. 7. Ich habe ihn seit gestern nicht gesehen. 8. Ich habe den Brief

nach seinem Hause geschickt. 9. Er ging aus dem Zimmer. 10. Ich war bei meinem Bruder. 11. Dies ist gegen das Gesetz.

EXERCISE 106 (Vol. II., page 156).

1. We cannot get through this forest. 2. I received these letters this morning through a kind acquaintance. 3. Along the river they saw the enemy's glittering arms. 4. One should be ready to sacrifice everything for a friend. 5. For this behaviour the father punished the boy. 6. They directed the cannons against the town. 7. You are not now nearly so frank towards me as was the case formerly. 8. The enemy shot all the prisoners without exception. 9. Without the father's interposition, the children might have caused a great misfortune. 10. Without doubt my friend will arrive here to-day. 11. In order not to increase the mother's fear still more, he did not tell her the truth in all respects. 12. Maria Theresa, empress of Austria, waged war for seven years with Frederick the Second, king of Prussia, about the possession of Silesia. 13. For this disease there is no medicine.

GEOMETRICAL PERSPECTIVE.—VII.

PROBLEM XX. (Fig. 40).—Upon the board of the last question (see Vol. III., page 73) describe a circle, the circumference touching the edges.

Fig. 39, Problem XIX., must be repeated: then upon $f b$ describe a semicircle, and about the semicircle the parallelogram $f h g b$; from z , the centre, draw $z h, z g$; through the points where these last lines cut the circumference draw lines parallel to $f h$ or $b g$, to i, k ; next, through the points i, z, k , draw straight lines parallel to $f a'$ or $b d$; draw the diagonals $a' d, c' b$, which intersect the parallel lines dropped from the incline $k z i$; the points of intersection numbered 1, 2, 3, 4, 5, 6, 7, 8, will be those through which the plan of the inclined circle must be drawn.

Before proceeding with the perspective delineation of the board and circle, as shown in the lower part of Fig. 40, we must detain the pupil whilst we examine the principles upon which the plan of the inclined circle is represented. The explanation given with Figs. 38 and 39 will be sufficient to clear all difficulties with respect to the board only. As the circle is lying on the board or inclined plane, the end or profile of which is $f b$, we must ascertain the whereabouts of the points through which the circle is drawn upon the incline. Let the pupil draw a square upon a separate piece of paper, and describe within it a circle, then hold the paper at an angle with the horizon, the inclined edge being opposite the eye, he will first see how from an inclined line we can represent the whole of a square, as illustrated by Figs. 38 and 39; but in this case we have the addition of a circle within the square, therefore the points through which the circle is drawn must be brought to the edge of the inclined square represented by the line $f b$ (Fig. 40); a semicircle will be sufficient to help us in this, as the opposite portions of the circle and the several points through which it passes correspond; therefore the method of construction above given will enable us to produce upon the plan of the board the plan of the circle also.

To proceed with the perspective representation, let the pupil draw visual rays from all the points in $c' d$ and $a' b$, to cut the respective sides of the perspective projection of the square; draw lines between the corresponding points on the opposite sides of the perspective square, and also the diagonal lines of the square: the points through which the circle is to be drawn by hand will be those which are found to answer to the same in the ground plan.

PROBLEM XXI. (Fig. 41).—A truncated pyramid has a square base of 1.5 inch side, the top is of 1 inch side, the height 2.5 inches. Give a perspective representation of the pyramid resting on a horizontal plane with the plan of the picture inclined to one of the edges of the base at an angle of 15° . The line of sight to be $\frac{3}{4}$ of the height of the pyramid.

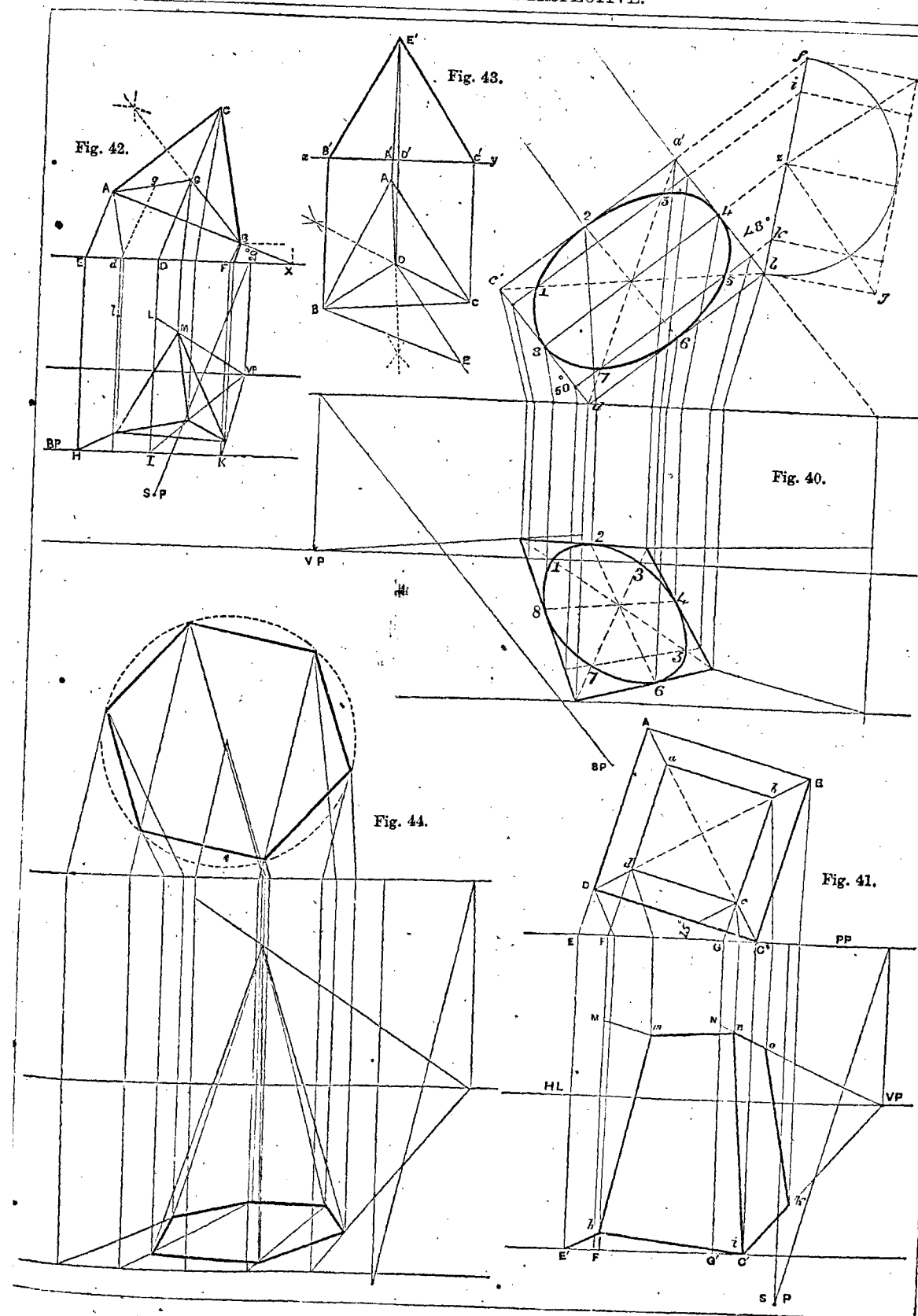
After placing the line $c d$ (an edge of the base) at the given angle, 15° with the PP, draw the plan according to the instructions given in Problem VI. (Vol. II., page 237). Here is an instance where the use of one VP only will be absolutely necessary; there are two sets of retiring lines, viz., $c d$ and its parallels, and $c b$ and its parallels; if we were obliged to determine the VP for $c d$ and its parallels, we should find by drawing from the station point a parallel to $c d$ that the VP would be at a very considerable and inconvenient distance out of the paper; therefore produce the parallels to $c b$, viz., $A d, a d$ and

$b c$, to the PP in the points $E F G$; determine the VP for these lines only, and follow the instructions given with reference to Figs. 27, 28, and 29 (Vol. III., page 9) in drawing the perspective of the base; the points of contact E and C will be the points to be brought down to E' and C' for the base. The lines of contact from F and G must also be brought down to the base of the picture upon which to measure the height of the pyramid $F' M$ and $G' N$. Divide $F' M$ or $G' N$ into three equal parts, and through the second from the base draw the line of sight parallel with the PP. Find the VP, to which draw lines from the points of contact E' and C' ; these lines cut by visual rays from D and B in the plan will decide the extent of the base in $h i$ and k . For the top lines must be drawn from M and N to the VP, and cut by visual rays from the plan of the top, as was done with the base; draw the inclined edges $m h, n i$ and $o k$; this will complete the subject.

PROBLEM XXII. (Fig. 42).—Supposing an equilateral triangle, having its side 2.5 inches, to be the base of a pyramid 2.5 inches high, draw a perspective representation of the pyramid. Assume one side of the base to be inclined at an angle of 20° with the picture plane, the nearest edge of the pyramid to be $\frac{1}{2}$ inch from the picture plane, and the observer's eye to be 5 inches from the picture plane, and 1.5 inch above the horizontal plane on which the pyramid stands, and opposite a point 2 inches to the left of the angle of the pyramid nearest the picture plane. (From a Military Examination Paper.)

Draw a line, $A x$, at an angle of 20° with the PP, determine the point $B \frac{1}{2}$ inch from the PP, and make $A B$ equal 2.5 inches, upon which describe an equilateral triangle, the base of the pyramid. The centre of the triangle must be found by bisecting two of the angles (or by bisecting two of the sides, because the figure is a regular one, having equal angles and equal sides); the intersection of the bisecting lines will be the centre at a , which is the plan of the apex of the pyramid. Produce the line $c a$ to D , and draw from A and B parallel lines to meet the PP in E and F . From E, D and F draw perpendicular lines to the base of the picture BP. Place the station point (SP), and draw the HL according to the given distance stated in the question; find the VP for $D a c$, which will also be the VP for the other parallel lines drawn from the plan to the PP: visual rays drawn from A, B, c , and cutting other lines drawn from $H i x$ to the VP, will at their intersections give the perspective positions of the several angles of the triangle, which must be completed by straight lines forming these angles. Thus far there is no particular difference in the rule for drawing the perspective of the base from the one given for the last problem and several others gone before; but we wish especially to draw the attention of our pupils as to which of the lines of contact $E H, D i$, or $F k$ must be the one upon which the elevation or height of the pyramid is to be set off. It will be easily understood, when we consider that the vertex of the pyramid is over the centre of the base, that the line of contact connected with the centre must be the one, viz., $D i$. Therefore upon $D i$ mark the height of the pyramid, viz., $i l$; from l draw a line to the VP, and a visual ray from G cutting this line in M will give the position of the vertex of the pyramid. Draw from M lines to meet the angles at the base, which will complete the representation required. Suppose the three inclined faces had not been equal, and that the plan of the vertex had been at g , then $g d$ must be drawn parallel to $a d$, the line of contact brought down, and from the height measured to l a line drawn to the VP, and the visual ray from g to cut this line, to find the vertex from which intersection the edges drawn to the angles at the base as before will represent the pyramid.

Suppose the solid to be a regular tetrahedron, that is, a figure with four equal faces, each face would then be an equilateral triangle; the height in this case would have to be found. This obliges us to have recourse to geometrical or orthographic projection. Upon a little reflection the pupil will see that the distance of the vertex from the ground will be less than the length of the edge of the pyramid; first, because a straight line drawn from an angle of the equilateral triangle to the centre of the opposite side is less than the side; and again, it would be further reduced because the triangular face is inclined. Now, how much the height may be less than the edge can be determined by the following mode of proceeding:—Let $A B C$ (Fig. 43) be the plan of the pyramid at the base, and D the plan of the vertex. Now it is understood that all the faces of this solid are equal, and that they are equilateral triangles. Again, we have the full



extent of each of the triangles represented by that of the plan A B C, therefore we know the length of the edges of the inclined triangles, of which A B D is the plan of one, B D C of the second, and A D C of the third. Of course the vertex of the pyramid will be perpendicularly above its plan in the centre D, therefore we must *rabat* the perpendicular, that is, turn it down upon the paper, and thus form the right angle B D E. From B with the distance B A or B C cut the perpendicular D E in E, join B E, which will represent the rabatted and inclined edge of the pyramid, whilst D E will represent the height of the pyramid. We may, perhaps, make it clearer in this way:—that as the line B D must be the plan of an inclined edge of the triangle A B D, of which B D is the plan, and because B E, the rabatted edge, is equal to B A, and D E perpendicular to D B, therefore D E must be equal to the height of E, the vertex from the ground. To represent the elevation draw B B', A A', and C C', at right angles with *xy* (the axis of the plane of projection), produce D D' to any length and make D' E' equal to D E; draw from E' lines to B', A', and C', which will represent the vertical projection or elevation of the pyramid. To draw the plan, and ascertain the height of the pyramid by the rabatment of the right-angled triangle B D E, will be all that is necessary to prepare the subject for the perspective representation. We have added the orthographic elevation, trusting it may assist the pupil to understand that the height is not equal to one of the edges.

To proceed with the perspective elevation, draw the plan as in Fig. 42, find its height by Fig. 43, and set off that height from *x* to *z* (Fig. 42). For the rest proceed as in Fig. 42. We will give another question similar in character to the last problem, for the pupil to work out by himself, without any accompanying explanation except the figure.

PROBLEM XXIII. (Fig. 44).—Give a perspective view of a regular pyramid on an hexagonal base, the height of the pyramid being equal to three times the length of one of the edges of its base. Assume that it is seen from a point to the right of it, and at a height above the horizontal plane equal to $\frac{1}{2}$ the height of the pyramid.

We will merely add that as no definite scale is given with the above problem, the pupil can please himself as to the size, only he must take care to observe the proportions mentioned. The expression "the horizontal plane" means the ground upon which it stands. The question is taken from one of the Military Examination Papers.

LESSONS IN ARITHMETIC.—XL.

AVERAGES, ETC.

3. THE *Average*, or *Mean*, of any set of numbers is the number obtained by dividing their sum by the number of different quantities forming the set. It is that number which, if placed in the position of each of the quantities forming the set, will, when added together, give the same result as the original quantities, when treated in the same manner.

EXAMPLE 1.—A man spends, in seven successive years, the following sums:—£200, £250, £300, £320, £180, £330, £210. What is his average or mean annual expenditure during that time?

The answer is $\frac{200 + 250 + 300 + 320 + 180 + 330 + 210}{7}$

which is £255 $\frac{1}{7}$.

If he spent £255 $\frac{1}{7}$ every year, he would in seven years have spent the same sum as he actually spent in that time.

EXAMPLE 2.—Out of 20 men, 6 die at 25 years of age, 3 at 30, 4 at 35, and 7 at 40. What is the average duration of their lives?

The total number of years they live is

$$(6 \times 25) + (3 \times 30) + (4 \times 35) + (7 \times 40),$$

which is 660 years.

Hence the average required is $\frac{660}{20}$, or 33 years.—Answer.

4. EXAMPLE.—How may a mixture of tea at 3s. 3d. a pound and tea at 4s. 9d. a pound be made so as to produce a mixture worth 4s. 6d. a pound?

We shall call 4s. 6d. the average price.

The tea at 3s. 3d. a pound is 1s. 3d. a pound cheaper than the mixture;

The tea at 4s. 9d. a pound is 3d. a pound dearer than the mixture.

It is evident that the amount by which the cost of the number of pounds of the first kind is less than the cost of the same num-

ber at the average price, must be equal to the amount by which the cost of the number of pounds of the second kind exceeds the cost of the same number at the average price. Hence,

$$\text{Number of first kind} \times 15d. = \text{number of second kind} \times 3d.$$

Hence the required number of pounds are in the ratio of 3 : 15, or 1 : 5, i.e., inversely, as the difference of the prices from the average price.

Hence, any pairs of numbers of pounds in this ratio will form a mixture of the required kind.

5. When there are more than two quantities at different prices, which are to be mixed?

This kind of question can be solved by the same principles. Separating the quantities to be mixed into two sets, one cheaper and the other dearer than the average price, we must evidently have the sum of the quantities which are cheaper than the average, multiplied each by the amount by which its price is less than the average price, equal to the sum of the quantities which are dearer, multiplied each by the amount by which its price is greater than the average price.

There is one difference, however, in this case and that of only two ingredients. In the latter, the ingredients must be mixed in one given ratio; in the former, an infinite number of numbers can be found, so that ingredients mixed proportionately to them will satisfy the required condition.

6. EXAMPLE.—How may teas at 3s. 6d., 4s., and 4s. 6d. a pound respectively, be mixed so as to form a mixture worth 4s. 2d. a pound?

Here the first two are less than the average price, and the last is greater; and the differences are 8d., 2d., and 4d. respectively.

Therefore,
No. of lbs. of first $\times$ 8d. + no. of lbs. of second $\times$ 2d. = no. of lbs. of third $\times$ 4d.

Take, then, any number of pounds of the first and any number of pounds of the second, at pleasure. We can then determine what number of pounds of the third must be mixed with these, so as to satisfy the required condition. As the simplest case, suppose we take 1 pound of each of the first two kinds. Then we have

$$\text{Number of pounds of the third} \times 4d. = 8d. + 2d. = 10d.; \text{ or,} \\ \text{number of pounds of the third} = \frac{10}{4} = 2\frac{1}{2}.$$

Now 1 : $2\frac{1}{2}$ are in the proportion of 2 : 2 $\frac{1}{2}$.

Hence 2 pounds of the first, 2 pounds of the second, and 7 pounds of the third will form a mixture worth 4s. 2d. a pound.

7. EXAMPLE.—How may wines at 15s., 18s. 6d., 20s., 26s., and 30s. a gallon respectively, be mixed so as to form a mixture worth 24s. a gallon?

The first three are in defect, the differences being 9s., 5s. 6d., and 4s. respectively; and the last two are in excess, the differences being 2s. and 6s.

Taking 1 gal. of each of the first four kinds, we must have

$$9 + 5\frac{1}{2} + 4 = 2 + \text{no. of gals. of last} \times 6.$$

Hence $\frac{9 + 5\frac{1}{2} + 4 - 2}{6}$ will give the number of gallons of the last kind,

which, mixed with one gallon of each of the others, will produce a mixture worth 24s. a gallon.

This reduces to $\frac{1}{2}$.

Hence 4 gallons of each of the first four kinds mixed with 11 gallons of the last will fulfil the required condition.

8. These examples will sufficiently explain the following Rule for determining a proportion of Ingredients at Different Prices, to form a Mixture at a Given Price.

Divide the differences from the average price into two sets—those which are in excess, and those which are in defect.

(1) When there are only 3 ingredients.

Add together the two differences which are of the same kind, and divide this sum by the third difference. This will give the quantity of the last, which must be mixed with one unit of each of the former.

(2) When there are more than 3 ingredients.

Add one set together, and subtract from the result the sum of the other set with one difference omitted. This result, divided by the omitted difference, will give the quantity of this last, which must be mixed with one unit of each of the former.

EXERCISE 61.

- Find the average of 3, 4, 5, 6, and 7.
- Find the average of 25, 34, 19, 0, 12, and 5.
- Find the average of 11 $\frac{1}{2}$, 4 $\frac{1}{2}$, 93 $\frac{1}{2}$, 0, 3'625, and 41.
- A master pays his labourers as follows: 20 receive 7s. a week,

15 receive 12s. a week, and 10 receive 18s. a week. What is the average price per week of a labourer's wages?

5. $\frac{1}{3}$ of a property pays 3 per cent.; $\frac{1}{4}$ 4 per cent., $\frac{1}{5}$ 5 per cent., and the remainder 6 per cent. What is the average per-centage received?

6. The populations of 4 parishes are 4,520, 3,250, 1,200, and 850 respectively. When they have increased respectively 5, 10, 15, and 20 per cent., find the average population of the 4 parishes; find also the average increase per cent.

7. How many three kinds of coffee at 1s., 1s. 4d., and 2s. a pound be mixed, so as to produce a coffee worth 1s. 6d. a pound?

8. Find a way in which sugar at 2 $\frac{1}{2}$ d., 3d., 3 $\frac{1}{2}$ d., and 4d. a pound may be mixed, so that the mixture will be worth 3 $\frac{1}{2}$ d. 4d. a cwt.

9. A vintner mixes wine at 15s., 20s., and 24s. a gallon respectively, in the proportions 5 : 3 : 1. What must he sell the mixture at to gain 20 per cent.?

10. How may spirits at 15s., 16s., 17s., and 22s. a gallon respectively be mixed with water so that the mixture may be worth (1) 10s. (2) 18s. a gallon?

KEY TO EXERCISES IN LESSONS IN ARITHMETIC.—XXXIX.

EXERCISE 60.

- | | |
|---|---|
| 1. 23 $\frac{1}{2}$ s., 21 $\frac{1}{2}$ s., 18 $\frac{1}{2}$ s., 16 $\frac{1}{2}$ s. | 4. £240 $\frac{1}{2}$, 276 $\frac{1}{2}$, £246 $\frac{1}{2}$, £230 $\frac{1}{2}$. |
| 2. £241 $\frac{1}{2}$, £344 $\frac{1}{2}$, £419 $\frac{1}{2}$. | 5. £750 each. |
| 3. £48, £72, £144. | 6. £180, £360, £270, £90. |

READINGS IN FRENCH.—IV.

MDLLE. DE LAJOLAIS.

SECTION I.

La galerie que devait (a) traverser l'Empereur, pour se rendre au conseil, était une vaste pièce longue, éclairée par des croisées parallèles; les uns ayant vue (b) sur la cour d'entrée, les autres sur les jardins. Neuf heures venaient de (c) sonner, et peu à peu les deux côtés de cette galerie se remplirent de (d) monde, de curieux, de solliciteurs, des officiers de service, des gens (e) de la maison. Parmi tout ce monde deux femmes se faisaient remarquer; la première par sa beauté, et l'air gracieux avec lequel elle accueillait (f) les saluts respectueux de tous ceux qui passaient près d'elle; et la seconde par son extrême jeunesse, par la pâleur qui donnait à sa beauté un caractère extraordinaire, et par ses beaux cheveux blonds tombant en boucles nombreuses sur ses épaules.

"Allons (g), du courage!" disait (h) la première à la seconde, "du courage!"

"Je ne vous quitterai pas," disait encore la première. Puis, pour donner plus de poids à ses paroles, sa main allait chercher la main de la jeune fille et la serrait avec amitié.

Le regard le plus expressif et le plus triste répondait à cette faveur; et incontinent les beaux yeux de l'enfant se retournaient vers la porte par laquelle devait (i) paraître l'Empereur. Toute cette âme jeune, aimante, exaltée, semblait avoir passé dans ses yeux; tout le reste de son corps paraissait (j) inanimé.

Deux heures se passèrent ainsi; deux heures d'attente, de peines, d'angoisses, et pendant ces deux heures, ni l'une ni l'autre de ces enfants n'avait bougé.

La jeune fille, tenant (k) les yeux attachés sur cette porte fermée, attendait qu'elle s'ouvrit pour respirer; pour vivre; l'autre ne détournait pas les yeux de dessus sa compagne.

Le plus profond silence régnait dans cette galerie; on n'entendait que la respiration plus ou moins agitée de tout ce monde, qui attendait aussi.

Enfin onze heures sonnent, les deux battants de la porte s'ouvrent, et un huissier annonce l'Empereur.

Plusieurs personnes paraissent (l) à la fois.

"Lequel?" demande Maria dans la plus vive anxiété.

"Le seul qui ait (m) son chapeau sur la tête," lui répond vivement Hortense.

La jeune fille n'en écoute pas davantage; ne voyant (n) plus qu'un seul être dans toute cette foule qui l'entourait, elle sort (o) des rangs, s'élance aux pieds de celui qu'on lui a désigné, s'écrie: "Grâce! grâce!" et joint les mains avec force en les levant vers le ciel.

COLLOQUIAL EXERCISE.

- Pourquoi l'Empereur devait-il traverser la galerie?
- Comment était cette galerie?
- Sur quoi les fenêtres avaient-elles vue?
- Que vit-on lorsque neuf heures furent sonnées?
- Que remarquait-on parmi tout ce monde?
- Par quoi se faisait remarquer la première?

- À quoi pouvait-on distinguer la seconde?
- De quelle couleur étaient ses cheveux?
- Que disait la première à la plus jeune?
- Que faisait-elle pour donner plus de poids à ses paroles?
- De quelle manière l'enfant répondait-elle à cette faveur?
- De quel côté se tournaient les yeux de l'enfant?
- Combien de temps les deux femmes attendirent-elles?
- Qu'attendait la jeune fille?
- Que faisait alors l'autre?
- Entendait-on du bruit dans la galerie?
- Qu'arriva-t-il à onze heures?
- Qu'annonça l'huissier?
- Comment Hortense désignait-elle l'Empereur?
- Que fit alors la jeune fille?
- Que fit-elle en s'écriant: "Grâce! grâce?"

NOTES.

- | | |
|---|----------------------------------|
| (a) Devait, was. | (h) From dire. |
| (b) Ayant vue, looking towards. | (i) Devait, was to. |
| (c) Venaient de sonner, had just struck. | (j) From paraître. |
| (d) De, with. | (k) Tenant, keeping; from tenir. |
| (e) Gens de la maison, attendants of the household. | (l) See note j. |
| (f) From accueillir. | (m) From avoir. |
| (g) Allons, du courage! come, cheer up! | (n) From voir. |
| | (o) From sortie. |

SECTION II.

À ces cris, à cette action imprévue, l'Empereur s'arrête en fronçant les sourcils.

"Encore!" s'écrie-t-il d'un ton d'impatience, "j'avais pourtant dit que je ne voulais plus de ces scènes-là!"

Et croisant ses bras sur sa poitrine, il voulut passer outre (a).

"Sire!" cria la jeune fille, à laquelle la position de son père donnait une énergie au-dessus de son âge, "je vous en conjure, écoutez-moi!" Au nom de votre mère, Sire, écoutez-moi! au nom de votre père, accordez-moi la grâce du mien! C'est mon père, Sire; il aura (b) été entraîné, séduit; pardonnez-lui! Oh! Sire, vous tenez la vie de mon père, la mienne dans vos mains. Ayez pitié d'une malheureuse enfant qui vous demande la vie de son père. Sire! Sire! grâce... pitié... pardon."

"Laissez-moi, Mademoiselle," dit l'Empereur, la repoussant assez (c) rudement.

Mais, sans se laisser intimider (il y allait (d) d'une existence trop chère), Mlle. de Lajolais, se traînant sur les dalles (e) de marbre de la galerie, criait avec angoisse—

"Oh! pitié, pitié, Sire!... grâce!... pour mon père! Oh! jetez au moins un regard sur moi, Sire!"

Il y avait (f) quelque chose de si déchirant (g) dans cette voix d'enfant demandant la vie de son père, que l'Empereur s'arrêta malgré lui, et regarda celle qui l'implorait avec tant (h) d'instance.

Mlle. de Lajolais était fort bien, mais, dans ce moment, sa beauté tenait (i) de l'ange. Blanche comme un cygne, la douleur donnait à ses traits un caractère énergique et passionné; ses beaux cheveux blonds ruisselaient (j) sur ses épaules; ses petites mains, crispées par la fièvre, avaient fini par (k) saisir une des mains de l'Empereur, et lui communiquaient leur chaleur brûlante. Agenouillée, le visage baigné de larmes, levant ses grands yeux bleus vers celui duquel elle semblait attendre la vie ou la mort, elle ne pouvait plus ni parler, ni pleurer, ni respirer.

"N'êtes-vous pas Mlle. de Lajolais?" lui demanda l'Empereur.

Sans répondre, Maria pressa la main de l'Empereur avec plus de force.

Il reprit (l) avec sévérité, "Savez-vous que c'est la seconde fois que votre père se rend coupable d'un crime envers l'État, Mademoiselle?"

"Je le sais" (m), répondit Mlle. de Lajolais, avec la plus grande ingénuité; "mais la première fois il était innocent, Sire."

"Mais, cette fois, il ne l'est (n) pas," répliqua Bonaparte.

"Aussi c'est sa grâce que je vous demande, Sire," reprit Maria, "grâce, ou je mourrai (o) devant vous."

L'Empereur, ne pouvant plus maîtriser (p) son émotion, se baissa vers elle en lui disant—

"Eh! bien, oui, Mademoiselle, oui, je vous l'accorde. Mais, relevez-vous."

Et, lui jetant un sourire d'encouragement et de bonté, il dégagea ses mains tenues (p) toujours avec force et s'éloigna vivement.

COLLOQUIAL EXERCISE.

1. Que fit l'Empereur en entendant ces cris?
2. Que dit-il d'un ton d'impatience?
3. Quelles paroles énergiques la jeune fille adressa-t-elle à Bonaparte?
4. Que dit l'Empereur et que fit-il?
5. Pourquoi Mlle. de Lajolais ne se laissa-t-elle pas intimider?
6. Qu'ajouta-t-elle en se traînant sur les dalles de marbre?
7. Que fit alors l'Empereur?
8. Quel caractère la douleur donnait-elle aux traits de Maria?
9. Où étaient les mains de l'enfant?
10. Que faisait-elle aux pieds de Napoléon?
11. Que lui demanda-t-il alors?
12. Quelle réponse lui fit Maria?
13. Que lui dit Napoléon, relativement à son père?
14. Que répondit-elle?
15. Que répliqua Bonaparte?
16. L'Empereur semblait-il ému?
17. Que dit-il?
18. Que fit-il avant de s'éloigner?

NOTES.

- (a) Passer outre, to go on, to proceed.
(b) Aura, has without doubt, probably.
(c) Assez rudement, with some abruptness.
(d) Il y allait, etc., so precious a life was in danger, at stake.
(e) Dalles, floor; literally, flat stones.
(f) Il y avait, there was.
(g) Déchirant, heart-rending.
(h) Avec tant d'instance, so earnestly.
(i) Tennait, resembled that.
(j) From ruitsseler.
(k) Fini par, mechanically, unconsciously; literally, at last.
(l) From reprendre.
(m) From savoir.
(n) L', co.
(o) From mourir.
(p) Tenuës, held; from tenir.

KEY TO EXERCISES TO LESSONS IN FRENCH.

EXERCISE 110 (Vol. I., page 406).

1. Ne savez-vous pas où demeure mon père? 2. Je sais où il demeure, mais je n'ai pas le temps d'aller chez lui aujourd'hui. 3. Combien de temps y a-t-il que le médecin demeure à Paris? 4. Il y a dix ans qu'il y demeure. 5. Combien de temps a-t-il demeuré en Angleterre? 6. Il a demeuré en Angleterre six ans et demi. 7. Pouvez-vous me dire où demeure le serrurier? 8. Il demeure chez mon frère. 9. Y a-t-il long-temps que vous attendez ce livre? 10. Il y a plus d'un an que je l'attends. 11. Combien de temps y a-t-il que M. votre fils apprend le grec? 12. Il y a deux ans qu'il l'apprend. 13. Combien de temps y a-t-il que M. votre frère a ce verger? 14. Il y a plus de six mois qu'il l'a. 15. Combien (de lieues) y a-t-il de Paris à Lyon? 16. Il y a cent seize lieues de Paris à Lyon. 17. Y a-t-il plus loin de Lyon à Genève que de Lyon à Turin? 18. Il y a plus loin de Lyon à Turin que de Lyon à Genève. 19. Combien de temps votre père a-t-il demeuré en Allemagne? 20. Il a demeuré deux ans en Allemagne, et six mois en Angleterre. 21. Combien de temps avez-vous demeuré à Rome? 22. Nous y avons demeuré plus d'un an. 23. Y a-t-il plus d'un an que vous apprenez l'allemand? 24. Il y a plus de quatre ans que je l'apprends.

EXERCISE 111 (Vol. II., page 10).

1. Has not that man changed his conduct? 2. He has changed his conduct. 3. Has not that large house changed masters? 4. It has changed masters; Captain G. has just bought it. 5. You are wet, why do you not change your cloak? 6. Because I have no other. 7. Does not your cousin often change her mind? 8. She very often changes it. 9. During the combat, did not that young soldier change countenance? 10. He did not change countenance. 11. Should not that invalid have a change of air? 12. The physician recommends him to go to another country. 13. Where is your grey horse? 14. I have it no longer, I exchanged it for a white one. 15. With whom have you exchanged it? 16. I exchanged it with the young man who lived here last month. 17. Can the merchant change this forty-franc piece for me? 18. He cannot change it for you, he has no change. 19. Have you the change for a guinea? 20. How many shillings are there in a guinea? 21. There are twenty-one. 22. Is not your little boy late in coming in again? 23. He is very long. 24. Do you not long to go to Italy? 25. I long to go thither.

EXERCISE 112 (Vol. II., page 10).

1. Pourquoi ne changez-vous pas d'habit? 2. Pour une très bonne raison, parceque je n'en ai pas d'autre. 3. Votre père a-t-il changé de maison? 4. Non, Monsieur, mais nous avons intention de le faire demain. 5. Cet enfant a-t-il changé de conduite? 6. Il a changé de conduite, il est très sage maintenant. 7. Votre frère n'avait-il pas peur, n'a-t-il pas changé de visage? 8. Il a changé de visage, mais il n'avait pas peur. 9. N'avez-vous pas changé de chambre? 10. Je n'ai pas changé de chambre, ma chambre est très commode. 11. Ne vous tarde-t-il pas d'être en France? 12. Il me tarde d'y être. 13. Mme votre mère ne tarde-t-elle pas trop? 14. Elle tarde bien à venir. 15. Avez-vous changé la pièce de quarante francs? 16. Je ne l'ai pas encore changée. 17. Pourquoi ne l'avez-vous pas changée? 18. Parce que votre père n'a pas de monnaie. 19. Avez-vous la monnaie d'une

guinée? 20. Non, Monsieur, je n'ai que douze schellings. 21. Combien de cents y a-t-il dans un dollar? 22. Il y en a cent. 23. Avec qui avez-vous changé votre cheval? 24. Je l'ai changé avec mon frère. 25. Je l'ai changé contre (or pour) un blanc.

EXERCISE 113 (Vol. II., page 10).

1. Is it necessary to have a passport to travel in France? 2. It is necessary to have one. 3. Do the English provide themselves with passports to travel in England? 4. A passport is not needed in England. 5. Do you like travelling on railroads? 6. I would rather travel on railroads than on common roads. 7. Have you brought your master-keys? 8. I have no master-keys, I have only common keys. 9. Did your brother come in a steamboat? 10. He came in a sailing-boat. 11. Have you a four-horse carriage? 12. No, Sir, we have only a one-horse gig. 13. Has your brother built a steam-mill? 14. He has had two mills built, a wind-mill and a water-mill. 15. Has your companion engaged a fencing-master? 16. No, Sir, he has already a drawing-master and a dancing-master. 17. How many bedrooms have you? 18. We have two. 19. Have you a bottle of wine? 20. No, Sir, but I have a wine-bottle. 21. Do you see the owls? 22. No, but I see the bats. 23. I have a four-wheel carriage.

EXERCISE 114 (Vol. II., page 10).

1. M. votre père est-il en Angleterre? 2. Non, Monsieur, il est en France avec mon frère. 3. Ont-ils pris des passeports? 4. Oui, Monsieur, ils en ont pris deux. 5. Faut-il avoir un passeport pour voyager en Amérique? 6. Non, Monsieur, mais il faut en avoir un pour voyager en Italie. 7. Y a-t-il un bateau à vapeur de Calais à Douvres? 8. Il y en a plusieurs. 9. Y a-t-il un chemin de fer de Paris à Bruxelles? 10. Il y en a un de Paris à Bruxelles, et un de Paris à Tours. 11. M. votre frère a-t-il acheté un moulin à vent? 12. Non, Monsieur, mais il a fait bâtir un moulin à vapeur. 13. Y a-t-il beaucoup de moulins à vent en Amérique? 14. Non, Monsieur, mais il y a beaucoup de moulins à eau et à vapeur. 15. Votre cousin apprend-il le dessin? 16. Il ne l'apprend pas, il ne peut trouver un maître de dessin. 17. Le maître d'armes est-il dans la salle à manger? 18. Non, Monsieur, il est dans le salon. 19. Votre cousin est-il dans sa chambre à coucher? 20. Non, Monsieur, il est sorti. 21. Combien de chambres y a-t-il dans votre maison? 22. Cinq: une cuisine, une salle à manger, un salon et deux chambres à coucher. 23. Y a-t-il des chats-huants ici? 24. Oui, Monsieur, et des chauves-souris aussi. 25. Avez-vous vu ces chefs-d'œuvre? 26. Oui, Monsieur, je les ai vus. 27. Les avez-vous envoyés au chef-lieu du département? 28. Je les ai envoyés. 29. Avez-vous un cabriolet à deux chevaux? 30. J'en ai un à quatre chevaux. 31. M. votre frère a-t-il une voiture à deux roues? 32. Il a une voiture à deux places.

EXERCISE 115 (Vol. II., page 42).

1. Will you lead your children to school? 2. I will take them to school and to church. 3. Will the gardener bring vegetables to market? 4. He will bring some there. 5. Where will you take that horse? 6. I will take it to the stable. 7. Will you feed it? 8. I will give it hay and oats. 9. Will you give it water? 10. I will take it to the watering-place. 11. Will you pay what you owe? 12. Will you not take a walk? 13. I will take a walk this afternoon. 14. Will you take a walk or a ride? 15. I will take a ride, and my sister will take a drive. 16. Will you walk much in your journey to Paris? 17. We will not walk at all. 18. Will you not call the pedlar? 19. I shall not call him. 20. Will you not buy that villa? 21. We will buy it if we can. 22. Will it not freeze this night? 23. I do not think so, it is too warm. 24. Will you not sow all the wheat which you (will) harvest? 25. I shall only sow a part of it; I shall sell the remainder. 26. I will seal my letters and (I will) carry them to the post-office.

EXERCISE 116 (Vol. II., page 42).

1. Le monsieur n'appellera-t-il pas ses enfants? 2. Il appellera ses enfants et ceux de sa sœur. 3. N'amènerez-vous pas vos enfants? 4. Je ne puis les amener. 5. Ne voulez-vous pas vous promener à cheval cet après-midi? 6. Nous nous promènerons en voiture demain. 7. N'achèterez-vous pas les chevaux de mon père? 8. Je ne les achèterai pas, je n'ai pas d'argent. 9. N'appellerez-vous pas le colporteur? 10. Je ne veux pas l'appeler, je ne veux rien acheter. 11. Payerez-vous le tailleur? 12. Je lui payerai mon habit. 13. Ne gèlera-t-il pas demain? 14. Il gèlera demain; il fait très froid. 15. Ne sèmeriez-vous pas de l'avoine dans ce champ? 16. Je n'y sèmerai pas d'avoine; j'y sèmerai du blé. 17. Mènerez-vous votre sœur à l'école? 18. Je l'y mènerai cet après-midi. 19. Ne mènerez-vous pas votre fils au marché? 20. Je ne l'y mènerai pas. 21. Le jardinier ne mènera-t-il pas son cheval à l'abreuvoir? 22. Il l'y mènera. 23. Donneriez-vous de l'avoine à votre cheval? 24. Je lui donnerai du foin. 25. Amènerez-vous votre fils? 26. Je l'amènerai demain. 27. Amènera-t-il son cheval? 28. Il amènera son cheval et sa voiture. 29. Pourquoi portez-vous ce petit enfant? 30. Il est trop malade pour marcher. 31. M. votre frère vendra-t-il ses propriétés? 32. Il n'en vendra qu'une partie. 33. Votre domestique ne portera-t-il pas la lettre à la poste? 34. Je la cachetterai et je la lui donnerai. 35. Donneriez-vous à manger à mon cheval? 36. Je lui donnerai à manger et à boire (à boire et à manger).

RECREATIVE NATURAL HISTORY.

THE NEWT AND SALAMANDER.

MANY of our readers must have frequently seen the common newt, or eft, so abundant in ditches, pools, brooks, and moist places. Whether the animal may have been the great water-newt (*Triton cristatus*, or crested newt), measuring six inches in length, or the small water-newt (*Triton punctatus*, or speckled newt), not more than half that size, the observer must have paused a moment to mark the motions of the creature. Both belong to the once dreaded salamander family; but no land salamander is found in Britain, their proper homes being in central and southern Europe. The whole family is closely allied to the frogs and toads, and has, both in ancient and modern times, excited the attention of naturalists. Our observations must be principally on the British newts, which, the reader will remember, are often called salamanders.

No one can mistake the large English water-newt for any other reptile. The orange tint and black spots on the under part of the body; the sides speckled with white dots; the overhanging upper lip; the body covered with little wart-like tubercles;—all give the animal a peculiar appearance. The crest along the back of the male is seen in the spring only, when the animal assumes its brightest tints and exhibits the greatest activity. Some of the foreign newts are much larger than our British kinds. The species found in the waters of the Alleghany and Ohio rivers is two feet long, being called in some parts the "fish salamander;" in others the "ground puppy," or young alligator.

The newts are, in some respects, peculiarly formed. Though belonging to the great division of vertebrated animals, they cannot be said to possess true ribs. An inspection of a skeleton will show the rudiments of these bones, looking as if the ribs had begun to grow and were then suddenly checked in their development. The vertebrae of the tail are very numerous, thirty-six having been counted in the tail of the small newt, and nearly the same number in that of the large water-ef. These numerous joints probably facilitate the rapid vibratory movements of the organ characteristic of this reptile, especially in spring. The bones of the fore-leg have a striking resemblance to a miniature human arm. The two bones—the radius, to which the hand is united, and the ulna, linked to the upper arm at the elbow joint—are both visible in the newt. Thus the grand unity of structure, so remarkable in the vertebrated animals, is clearly to be traced through all the links which connect the highest forms with the lowest. One plan is seen amidst all the diversities. The legs of the newt, though small, are used in combination with the tail to support the animal in a remarkable way on the surface of the water. These reptiles may often be seen floating on the surface of a pool, with so little motion that they appear dead. The legs are extended on the water, the feet spread out, and the

tail tremulously vibrated. The creature thus floats as easily as if it were a piece of wood. The newts are then, generally, looking out for a dinner. No sooner does some small animal come near than it is seized with a ferocity which we should not have expected to find in these timid reptiles. The tadpole of the frog meets with no mercy, and indeed the large newt, when hungry, will swallow its relative, the small water-ef, without hesitation. The teeth of these reptiles, though fine, are sharp and numerous, looking like a saw of minute points. Some foreign species, closely allied to our newts, possess above three hundred of these needle-like teeth. Few persons looking at a newt as it swims in a ditch would suppose that such an insignificant creature has been the subject of study and experiments by some of the greatest physiologists and anatomists. A deep mystery of life was the problem to be solved; and in spite of all the labours of men like Spallanzani, Duméril, Bonnet, Von Siebold, and Owen,

the solution has not been made. The legs of newts have been repeatedly amputated, and have grown again. The limb when thus reproduced has been again cut off, and again has it been formed. In one case the same leg was thus amputated and thus re-formed four times in succession. The tail has shown again and again the same mysterious vital energy, forming gradually new bones, new nerves, and new muscles. These fresh limbs were not always reproduced exactly in their original form and perfection. Sometimes a claw would be deficient; sometimes redundant. The eye was completely removed from a newt; in a year a perfectly-formed new eye was reproduced. No part of the complex organ of vision was wanting, no part distorted. The above experiments show a singular power of reproducing destroyed organs; the following illustrates an extraordinary degree of vital energy. M. Duméril cut off all that part of a newt's head which contains the eyes, nostrils, ears and tongue, and then placed the creature in water at the bottom of a jar. Fresh water

was supplied every day, and the animal's motions were carefully watched for about three months. The newt came to the top of the water at first, as if to breathe; its movements were slow, as if perplexed by its novel condition, but the creature continued to live, and retained all the vital energies unimpaired. The wounded part healed, new flesh was formed, and the hole made by the scissors in cutting off the head was completely closed within three months. How did the animal breathe? Probably through the skin, which thus discharged the office of a lung. How long the newt would have lived, and whether any reproduction of the lost head might have ensued, must be left doubtful. The reptile, having been left in charge of a fresh attendant, died from inattention, not being supplied with fresh water. The above experiments were made in the spring, when the newt's vital energies are most active and most able to recover from the shock which such mutilation must give, even to a reptile's system.

A series of observations were carried on by the naturalist



THE TRITON CRISTATUS, OR LARGE WATER-NEWT.

Rusconi, in order to trace all the steps by which a water-newt advances from the egg to its perfect state. The egg was noted on the 23rd of April, when it was deposited by the parent on a leaf, and the daily changes were watched under the microscope until the 6th of May, when the young newt was hatched. The water was kept all the time at a temperature of about 70° of Fahrenheit's thermometer. Want of space prevents us from describing all the steps in the development of the animal, but many readers can conduct a similar series of observations for themselves. We will, however, note a few of the more important stages in the advance. In five days the head, gills, forefeet, and tail were first seen in the egg; in four days more the beating of the heart was noticed; in another day the little creature moved in the egg; and on the 5th of May the eyes were clearly seen. On the next day the struggles of the imprisoned reptile broke its shell, and the newt was hatched. The second set of observations now began, by which the progress of the animal was noted through all the tadpole stages to the fully-developed animal. The little fish-like reptile secured itself by two hook-like appendages to a leaf, and then seemed to go to sleep for a day or two. On the 18th of May, twelve days after the hatching, the newt measured about half an inch long; the toes of the fore-feet were formed, the gills appeared; the tadpole was able to swim actively, and even to catch aquatic insects. On the 28th of May it had grown to the length of an inch; the hind-legs appeared, and the toes of the fore-leg were nearly perfect. On the 18th of June the tadpole reached its final stage, and then began to change into the newt. The gills were gradually obliterated, the lungs formed, the ear-holes closed, and on the 27th of July the reptile took the complete form of a water-newt.

We must now pause to describe the ingenious method by which the eft* secures the safety of her eggs, and shows herself to be a clever mechanic. She selects a leaf of some water-plant, deposits a single egg upon the under-side of the leaf, then with her feet bends the leaf back, so that it forms a case or box for the egg. But the leaf, thus doubled back, would soon straighten again, and leave the egg unprotected. To prevent this, the newt pours out a gummy fluid from her body, and glues the bent part of the leaf to the other or lower portion. Thus a protecting receptacle is formed for the egg, where it is hatched in security. The mode in which this leaf-nest is formed, and the exact order in which all the stages of the work proceed, may almost lead some to suspect that the newt "must be able to reason." These bent and doubled leaves may often be seen in places where efts abound, and by breaking three or four off and putting them into a jar, with water not lower in temperature than 65° Fahrenheit, the reader may watch all the stages of a newt's life.

We must now make a few remarks on the eft's relative, the once dreaded salamander. Never was an animal so hated with so little reason. The salamander proper (*Salamandra maculosa*) resembles the newts in form, but it dwells on the land, loving cool holes under old walls, and the roots of trees. One quality universally ascribed to this reptile was its power of living in the fire. It was one of "the best proved facts" in natural history that the salamander was the "lord of fire." Francis I. of France showed his belief in the marvellous tale by adopting for his device a salamander in the flames, thereby hinting to his foes that he, like that fearful reptile, was indestructible. The wild belief in some countries was that if a fire should ever be allowed to continue burning for seven years, a salamander would be produced from such flames. This superstition, however, was not the cause of the intense hate borne towards the salamander, but it invested the animal with a dread mysteriousness. How could such a notion continue through so many ages, when the matter might have been easily tested by throwing a salamander on the fire? People are not willing to put their superstitions to the test, and there was one slight foundation of fact on which the whole monstrous pile of error was raised. The salamander can pour out a little watery fluid from its skin when excited, and on some occasions this fluid may have damped for a moment the flame of some fire, on which the animal may have been cast. The poor salamander was also believed to have the deadly power of poisoning, not only the whole fruit of a tree on which it might creep, but the vegetation of a large district. Even innocent cows were not safe from the malicious reptile, which sometimes

* Readers will remember that the animal is called both eft and newt.

sucked their milk, robbing them and the irritated farmer by one felonious act. The bite of the creature was deemed so deadly that a proverb expressed the fears of men and the helplessness of the physician. "If a salamander bites you, put on your shroud," was the doleful counsel given to the luckless wight who might have been scratched by the tiny teeth of this animal.

Could no good, then, be obtained from the horrid creature? Yes; the heart, worn round the neck, would preserve the wearer from perils by fire! The chemists of old times professed to be able to turn the salamander to a wondrous use. The mode of operation and the expected results may thus be stated:—Catch one of the reptiles, put it in a crucible on a fire, pour quicksilver over the roasting animal; then, if all went well, the metal would be turned into gold! But one caution was essential: the operator must be a man of pure mind and heart, or no treasure would appear. The universal failure of the experiments speaks little in favour of the moral condition of the old chemists.

The reader will see, from the preceding remarks, how ignorance has filled the minds of men with abject dread of nature. War against the animal kingdom was the result. It is not the least advantage of natural history that it has dispelled most of these delusions, while it discloses innumerable wonders of structure, and remarkable instances of animal ingenuity.

LESSONS IN CHEMISTRY.—XX.

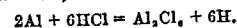
CLASS III.—THE METALS OF THE EARTHS.

In the third class of metals are those whose oxides have not such marked basic properties as either of the preceding classes, and they are therefore denominated metals of the earths, not alkaline earths. They are ten in number—aluminum, glucinum, zirconium, thorium, yttrium, erbium, terbium, cerium, lanthanum, and didymium. None of the group present sufficient interest to require our attention except—

ALUMINUM OR ALUMINIUM.

SYMBOL, Al.—COMBINING WEIGHT, 27.4.—SPECIFIC GRAVITY, 2.6.

This metal may be obtained by decomposing its chloride by the galvanic current; but, as in the case of magnesium, an easier method is found to be by the agency of sodium. The chloride, melted into vapour, is caused to pass over melted sodium; this latter metal appropriates the chlorine of the salt, and the aluminum is deposited. It is a bluish-white metal, remarkable for its lightness. It does not readily oxidise when exposed to air. These properties have recommended it for the making of ornamental trinkets. It is capable of being drawn out into wire and rolled into plates. When struck it gives a clear musical note. It is but little affected by nitric, but dissolves with rapidity in hydrochloric acid, giving off hydrogen, and forming the chloride; thus—



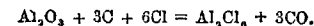
Hence the metal is *Triatomic*. It promises to become of some value in making alloys. Ten of aluminum and ninety of copper produce an alloy of great strength and elasticity—the "Aluminum bronze." Its appearance is very like gold.

Alumina (Al_2O_3) is the only oxide. It appears almost pure, and in a crystalline state, in the precious stones—corundum, ruby, sapphire. Emery is another form of this substance. It is also present in considerable quantities in clay, being originally derived from the decomposition of felspar. For commercial purposes it is got by treating a solution of soda-alum with hydrochloric acid, which is evaporated to dryness and heated; the mass is then washed with water, and alumina remains. Its chief use is in dyeing; it possesses the property of combining with certain organic colouring matters, and forming insoluble pigments termed *lakes*. Most colouring matters will not remain in the fibre of the material; when this is the case, the cloth, etc., is soaked in a preparation of alumina, and then dipped into a bath of the dye. By this means an insoluble compound is formed in the fibre of the material, and the substance is dyed "fast." The sesquioxides of iron and chromium, and the oxide of tin, are *mordants* as well as alumina.

Aluminum Chloride (Al_2Cl_6).—The process which would at once suggest itself for obtaining this salt—namely, of acting on alumina with hydrochloric acid—does not admit of being practised, for on evaporating and heating the acid is driven off.

The method devised by Oersted is therefore used. Alumina

is mixed with powdered charcoal, and made into a paste with oil or starch; the mass is subdivided into pellets; these are placed in a tube of porcelain, which is heated in a charcoal furnace, and a current of chlorine is passed through it. The aluminum chloride condenses in a cool receiver. The chemical action is thus expressed—



Aluminum Sulphate (Al_2SO_4) is made for the use of the dyer in large quantities in the north of England. Clay, which has been roasted, is acted upon by half its weight of sulphuric acid. At Whitby, however, this addition of acid is unnecessary. The alum schist contains iron pyrites, and in the slow roasting some of the sulphur of this compound becomes sulphuric acid. Water is added, and the clear liquid is drawn off; the iron it contains is precipitated as Prussian blue by sodium ferrocyanide. On evaporation, thin flexible scales of the salt are obtained.

Alums are double salts formed by aluminum sulphates and an alkaline sulphate; thus common alum is $\text{Al}_2\text{K}_2\text{SO}_4 + 24\text{H}_2\text{O}$, that is, it is a compound of Al_2SO_4 and K_2SO_4 (potassium sulphate) with twenty-four molecules of water of crystallisation. It is found native in volcanic neighbourhoods, where the sulphuric acid from the volcano has combined with the potash and alumina in lava to produce it. At the Whitby Alum Works the iron is not precipitated as Prussian blue. In the roasting it becomes green vitriol (sulphate of iron). To the clear liquid, which contains aluminum sulphate and iron sulphate, a solution of potassium chloride is added. The iron sulphate now becomes iron chloride, and the potassium sulphate with the aluminum sulphate form alum. This is separated by crystallisation, and sent to market.

Soda Alum, or Ammonia Alum, may be made by using the salts of those alkalies, instead of the potassium salt, in the above process.

The sesquioxides of iron, chrome, and manganese are capable of taking the place of alumina, with its compounds; hence they are said to be *isomorphous* with alumina. When they do this in alum, iron alum, chrome alum, or manganese alum is produced. Clay is aluminum silicate, and is the result of the decomposition of felspar, one of the constituents of the primary rocks. When clay is got directly from the felspar, it is called *kaolin*, or porcelain clay.

Clay, when it absorbs water, becomes soft and plastic, offering the best of mediums by which the tender rootlets of plants can take up the potash, ammonia, etc., necessary for their growth. The clay used for making bricks must have a large proportion of silica in its composition.

The following table will at once show the difference of the various clays:—

	Cornish Kaolin.	Stourbridge Fire-clay.	Pipe-clay.	Blue-clay.	Brick-clay.
Silica . . .	49.32	64.10	53.66	46.38	49.44
Alumina . .	39.74	23.15	32.00	38.04	34.26
Iron Oxide .	0.27	1.58	1.35	1.04	7.74
Lime . . .	0.36	...	0.40	1.20	1.48
Magnesia . .	0.44	0.95	trace	trace	5.14
Potash } . .	12.67	...	...	...	...
Soda } . . .	...	...	...	...	...
Water . . .	...	10.00	12.08	13.57	1.94
	99.80	100.05	99.49	100.23	100.00

* Alumina enters into the composition of numerous minerals.

The *zeolites* contain their water of crystallisation, and therefore swell up before the blow-pipe—hence their name. Analcime, catrolite, and stilbite are examples of this class. Granite, basalt, garnet, mica, and lazulite are familiar aluminous minerals.

GLASS, PORCELAIN, ETC.

Glass is a compound of silicates of the alkalies and of the alkaline earths; its properties are too well known to require description. There are various kinds of glasses which have certain distinctive properties due to their composition which render them valuable for specific purposes.

Window glass consists of silicates of soda and lime. Soda produces a more fusible glass than potash; and lime increases its lustre and hardness. One of the best manufactories of plate glass is at St. Gobain, in France, where these ingredients are used:—

300 parts of white sand (silica), 100 of carbonate of soda, 43 of slaked lime, and 300 of *cullet*, or broken glass, of the same kind. These ingredients are placed in a conical crucible and melted. The crucible is allowed to stand some time in a high temperature, in order that any impurities may settle to the bottom. The fused glass is then poured out on a table of cast iron, and the thickness is regulated by ledges of the same metal. The liquid glass is made to cover this table rapidly by a heavy roller passing over it.

As is the case with all glass, the plate is next *annealed*, that is, it is allowed to cool very slowly in an oven whose temperature is gradually diminished during a fortnight. If glass be cooled at all suddenly, it becomes so brittle as to be useless. The grinding and polishing of the plate is effected by causing one plate of glass to move upon the surface of another by machinery, the grinding materials being fine sand and water. When a smooth surface is thus obtained, the plate is polished, first by fine emery and then by peroxide of iron.

Bohemian glass is a silicate of potash and lime, and on account of its infusibility is used in the laboratory.

Bottle glass, the colour of which is immaterial, is composed of 100 parts of sand, 80 of soaper's waste, 80 of gas lime, 5 of clay, and 3 of rock salt.

Flint glass has these ingredients:—Pure sand, 100; red lead, 20; pearl-ash, 40; nitre, 2; and cullet, 100.

The lead gives great lustre to the glass, by increasing its refractive power; hence this glass is used for optical purposes. In its manufacture the crucibles are closed, lest the air should "reduce" the lead. It will be frequently observed that this takes place in a piece of tubing, if held in the blow-pipe flame for some time. It at first appears as if the tube were "smoked."

Coloured glasses are obtained by the addition of various metallic oxides. Gems are imitated by making a glass which contains as much as 53 per cent. of lead oxide. This is termed "paste."

Porcelain differs from glass in the great preponderance of silicate of alumina in its composition. It consists mainly of clay, which is infusible, and some alkaline silicate which fuses and binds the clay together, rendering it impervious to moisture. The fineness of the ware entirely depends on the purity of the clays, etc., from which it is made. The glaze which covers porcelain is produced by dipping the "biscuit" ware into water in which is suspended finely-ground felspar; the porous mass absorbs the moisture, leaving the surface covered uniformly with the felspar. It is then exposed in *seggars* to a very high temperature, by which the felspar is melted and the glaze produced. Stone ware and common "pottery ware" are glazed by means of common salt. The ware is dipped in sand and water, placed in the furnace, into which has been thrown moist salt. The heat quickly converts the salt into vapour. In the presence of the steam the silica on the ware decomposes the salt, forming a silicate of sodium which glazes the article, and hydrochloric acid which escapes. The other nine metals of this class having no interest, we pass to—

CLASS IV.—METALS PROPER.

ZINC.

SYMBOL, Zn.—COMBINING WEIGHT, 65.—SPECIFIC GRAVITY, 7.1.—MELTING POINT, 423° CENT.

This metal is never found native, but is associated with sulphur and carbonic acid in its two chief ores, *blende* and *calamine*. The former is zinc sulphide, and in England is usually found with galena, the sulphide of lead, in mountain limestone; the latter is zinc carbonate, of which there are mines in the Mendip Hills.

Extraction of the Metal from its Ores.—The ore, after being crushed, is roasted; by this process the sulphur of the blende is burnt away as SO_2 , and the carbonic acid of the calamine is given off.

The oxide of zinc which remains is mixed with half its weight of powdered coal, and placed in large clay crucibles; these are heated in a furnace, their delivery tubes passing through holes in the walls. At first the blue flame of carbonic oxide issues from them, and when this changes to white the metal is distilling. A long iron pipe, eight feet long, is then fitted on the discharge pipe, and zinc distils into iron vessels placed to receive it at the end of this tube.

Zinc is a very crystalline metal. A little below 150° it is soft

and ductile, but at 200° it becomes so brittle as to bear pounding in a mortar. At a bright red heat it melts and volatilises, and its vapour burns with a bright yellowish flame into the oxide.

Zinc can decompose both steam and carbonic acid at a red heat, and, as we have seen, is dissolved in sulphuric, nitric, and hydrochloric acids, giving off hydrogen and forming the corresponding salt. With nitric acid, however, the action is varied with the strength of the acid and the temperature; nitric oxide, nitrous oxide, nitrogen, or ammonia being given off according to circumstances.

Zinc precipitates all metals less oxidisable than itself from their solutions; but a strong boiling solution of potash dissolves it, hydrogen being liberated and an oxide of zinc formed, which is dissolved by the alkali. When exposed to the air, it becomes covered by a firmly-adhering coat of oxide, which protects the metal beneath from any further action of the air; hence it is used to galvanise iron, which is effected by plunging a sheet of iron, perfectly clean, into a bath of molten zinc, covered by sal-ammoniac; the zinc readily adheres to the iron.

It forms many useful alloys. Brass is the most important, consisting of two parts of copper and one of zinc. German Silver is brass whitened by the addition of a little nickel.

Zinc Sulphate, or White Vitriol (ZnSO₄), appears, when a solution of zinc in sulphuric acid is evaporated, as colourless four-sided acicular prisms.

Zinc Sulphide (ZnS) is precipitated as a white gelatinous mass when sulphuretted hydrogen passes through a solution of zinc sulphate. The presence of a mineral acid prevents the precipitation.

Zinc Chloride (ZnCl₂) is largely used as an antiseptic, as "Burnett's Disinfecting Fluid." It is easily obtained by dissolving the metal in hydrochloric acid.

The salts of zinc are distinguished by giving no precipitate with sulphuretted hydrogen in acid solutions. They yield a white precipitate, with potash, soda, or ammonia, which is soluble in excess of the alkali.

If placed on charcoal in the blow-pipe flame, when moistened with cobalt nitrate, a green residuum remains, which is not fusible.

LESSONS IN ITALIAN.—IV.

III.—THE SEMI-VOWELS (continued).

I HAVE not yet spoken of the letter *H*. It is named in the alphabet *acca* (pronounced ah'k-kah). According to its alphabetical sound, and because its two syllables are substantially one, only placed inversely, it might be classed as a semi-vowel; but as it is only an auxiliary letter to modify the sounds of *c* and *g*, as I shall have occasion to explain fully hereafter, it is a mere soundless, written sign, not a letter. It also serves to distinguish the words *ho*, I have, from *o*, or; *hai*, thou hast, from *ai*, dative plural of the article; *ha*, he has, from *a*, the preposition "to"; and *hanno*, they have, from *anno*, the year. This distinction is, however, only for the eye, for, in pronouncing, the *h* is quite mute; and some purists, headed by Metastasio, instead of an *h*, put the grave accent in those first four words.

The Italian has no aspirates, which essentially distinguishes it from the leading languages of Europe. Only in the middle, and at the end of some few interjections, a kind of aspiration is heard, which is only produced by the prolongation of the sound of the vowel, or of the transition of the voice from one vowel to another—principally, however, by a more emphatic emotion by which such interjections are thrown out; as, for example, ah! ah! deh! ahimè! eh! oh! oh! ohimè! doh!

In the early period of the language, the Italians wrote all words manifestly of Latin origin with an initial *h*; as, for example, *habile*, now *abile*; *hanno*, now *anno*; *hora*, now *ora*; *historia*, now *istoria*. This insignificance of the *h* has given rise to some proverbial expressions: as, "*Questa cosa non vale un'acca*," "this is not worth an *h*," or, as an Englishman would say, "not worth a fig, or a farthing;" or, "*Non m'importa un'acca*," "I don't care an *h* for it," or, as an Englishman would say, "I don't care a straw for it;" or "*Non ne saper un'acca*," "not to know an *h* of something;" or, as is often said in England, "an *iota* of it." When an Italian has to pronounce the *h* in another language, it is only with the greatest difficulty he can master it.

To complete my remarks on the alphabet, I must now say something of the letters *K*, *W*, *X*, and *Y*, important letters in English, but which do not occur in Italian.

Instead of *k*, the Italians use before consonants, and before the vowels *a*, *o*, and *u*, the letter *c*; and before the vowels *e* and *i*, *ch*. For example, instead of *Kalend*, the Italians write *Calende*.

The English letter *w* does not occur at all in Italian.

The letter *X*, which represents, properly speaking, a compound sound (ks), is unknown in pure Italian words, and the English sound is never heard. In words of foreign origin, which would have this sound in English, the Italians place an *s* or *ss*, or *c*; as for the word *example* (from the Latin *exemplum*), the Italians write *esempio*; for *extreme* (from Latin *extremus*), they write *estremo*; for *Xenophon*, *Senofonte*; for *Xerxes*, *Sersè*; for *Alexander*, *Alessandro*. The letter *c* replaces the *x* in words which are the compounds of the prefix *ex*, when *c* follows it; for example, for *excellent* they write *eccellente*; for *excess*, *eccesso*, etc. Custom has, however, sanctioned the use of the *x* in a few words of Greek origin, for *Xantippe* and *Xanto* (*Xanthus*, the river in Asia Minor) are just so written in Italian. They are nevertheless pronounced as if they were written *Santippe* and *Santo*. (The latter word has retained the *x* principally that it might not be confounded in writing with the word *Santo*, a saint.)

The letter *y* is always replaced in Italian by *i*; as, for example, for physics (physical science), the Italians say *fisica*; for stygian, *stigio*.

SECOND PRONOUNCING TABLE,

Showing the combination of Vowels with Semi-Vowels in Natural Order.

That my pupil readers may thoroughly exercise themselves in pronunciation, in order to give a complete illustration of the junction of vowels and semi-vowels in natural order, I have selected words of two syllables, in which the first syllable of the first word is the same as the concluding syllable of the second.

Italian.	Pronounced.	English.
<i>Fra</i>	fà-rai	Beasts.
<i>Refe</i>	rai-fai	Thread.
<i>Foce</i>	fà-tchai	Mouth (of a river).
<i>Cefo</i>	tché-fo	A monkey.
<i>Fugo</i>	fù-go	I put to flight.
<i>Gufo</i>	gù-fo	A horned owl.

The vowel *u* in Italian, as a final letter, is only to be found in monosyllables; as, *tu*, thou; *fu*, was; or in those words that have the grave accent on the last syllable; as *virtù*, virtue; *Corfù*, Corfu. I am therefore compelled, by the use of the word *gufo*, and others to follow, to depart from the strict system.

<i>Lago</i>	là-go	Lake.
<i>Gola</i>	gù-lah	Throat.
<i>Leso</i>	lài-zo	Hurt.
<i>Solo</i>	sù-lai	Sun.
<i>Lice</i>	lè-tchai	It is permitted.
<i>Cieli</i>	tché-lee	The heavens.
<i>Loze</i>	lù-dai	Praise.
<i>Delo</i>	dè-lo	Delus.
<i>Luno</i>	lù-mai	Light.
<i>Mulo</i>	mù-lai	Mules.
<i>Maro</i>	mà-ro	Wild basil.
<i>Roma</i>	rù-mah	Rome.
<i>Mese</i>	mài-zai	Month.
<i>Seme</i>	sai-mai	Seed.
<i>Mira</i>	mèe-rai	The sight in artillery, aim.
<i>Rami</i>	rai-mee	Branches.
<i>Modo</i>	mù-do	Manner, mode.
<i>Domio</i>	dù-mo	Tamed.
<i>Muro</i>	mù-ro	Wall.
<i>Rumo</i>	rù-mo	I reconsider.
<i>Nave</i>	nàh-vai	Ship.
<i>Vena</i>	vai-nah	Vein.
<i>Nera</i>	nai-rah	Negress.
<i>Rane</i>	rai-nai	Frogs.
<i>Nice</i>	nèe-tchai	Berenice, a woman's name.
<i>Ceni</i>	tchai-nee	Thou supposest.
<i>Nome</i>	nù-mai	Name.
<i>Meno</i>	mài-no	Less.
<i>Nuca</i>	nù-kah	Nape of the neck.
<i>Cuna</i>	kù-nah	Cradle.
<i>Edo</i>	rai-do	Thin, rare.

<i>Dora</i>	dù-rah	He gilds.
<i>Reso</i>	rai-zai	Surrenders (cf towns).
<i>Sere</i>	sè-rai	Sir.
<i>Rido</i>	rèe-do	I laugh.
<i>Dori</i>	dù-ree	Thou gildest.
<i>Roba</i>	rù-bah	Property, victuals, merchandise.
<i>Raro</i>	ràh-ro	A cheat. [robe.]
<i>Rude</i>	rù-dai	Rude.
<i>Dure</i>	dù-rai	Durations.
<i>Sara</i>	sàh-rah	Sarah.
<i>Rasa</i>	rai-zah	Erased.
<i>Seco</i>	sai-ko	With himself.
<i>Cosa</i>	kù-sai	Things.

This is the plural of *cosa*, thing (pronounced kù-sah), one of those exceptional words where the *s* must be pronounced with a sharp, hissing sound, though it is placed between two vowels. This exception should be imprinted on the reader's memory, because, as is obvious from its meaning, the word is of the most frequent occurrence.

<i>Sire</i>	sè-rai	Formerly Sir, now Sire.
<i>Reso</i>	rai-zo	Rendered.
<i>Soma</i>	sù-mah	Burden.
<i>Maso</i>	màh-zo	Tom.
<i>Befare</i>	bef-fah-rai	To scoff.
<i>Offeso</i>	of-fai-zo	Offended.
<i>Soffice</i>	suf-fec-tchai	Soft, flexible, supple.
<i>Soffogo</i>	suf-fò-go	I suffocate.
<i>Sufuso</i>	soof-fù-zo	Wetted.
<i>Corallo</i>	ko-ràh-lo	Coral.
<i>Vitello</i>	vee-tèl-lo	Calif.
<i>Cavillo</i>	kah-vi-lò	I annoy, quibble.
<i>Satollo</i>	sah-tàl-lo	Satisfied, satiated, tired.
<i>Catullo</i>	kah-tùl-lo	Catullus.
<i>Cenammo</i>	tchai-nàm-mo	We supped.
<i>Dilemma</i>	dee-lèm-mah	Dilemma (logicar).
<i>Enigma</i>	ai-nim-mah	Enigma. [chin.]
<i>Sommommo</i>	som-mòm-mo	A blow with the fist under the
<i>Affummo</i>	ah-fù-mo-mo	I smoke (meat).
<i>Inganno</i>	in-gàn-no	Deceit.
<i>Antenna</i>	ahn-tèn-nah	Yard (of a ship).
<i>Erinni</i>	ai-rin-neo	The Furies.
<i>Aronia</i>	ah-rùn-nai	Aaron.
<i>Alunno</i>	ah-lùn-no	Alumnus, pupil.
<i>Ciparra</i>	kah-pàh-rai	Earnest money.
<i>Atterro</i>	ah-tèrr-ro	I knock down.
<i>Butirro</i>	boo-tirr-ro	Butter.
<i>Ricorro</i>	ree-kùrr-ro	I recur.
<i>Azzurro</i>	ah-dzùor-ro	Azure.
<i>Abbaso</i>	ahb-bàh-so	Low.
<i>Orasso</i>	os-sà-so	Possessed, bored, dunned.
<i>Affisso</i>	ahf-fis-so	Affixed.
<i>Indosso</i>	in-dùs-so	Upon the back.
<i>Concusso</i>	con-kùos-so	Moved, shaken, contrite.

GREAT BOOKS.

XIV.—THE VICAR OF WAKEFIELD.

NOVELS at the present day have become a species of manufacture. The demand for them is so vast, and so constantly increasing, that it may almost be said they are produced to order, and the wonder is, not that so many are worthless, but that so much ability should be exhibited in the composition of a considerable number every year. At the beginning of last century, the novel, as we now understand it, was unknown in England. Defoe was the first to produce those popular fictions which are such powerful agents either for good or evil; but the stories of Defoe do not exactly answer to the idea of the novel, as a picture of society and manners in the general, without reference to class portraiture, or the definite inculcation of morals. Fielding is usually regarded as "the father of the English novel;" yet his "*Joseph Andrews*" was preceded by Richardson's "*Pamela*," of which it was in some degree a burlesque. But Richardson, as Sir Walter Scott has observed, never succeeded in freeing himself from the trammels of the French romance; he therefore, in this matter, gives place to Fielding. By the middle of the eighteenth century, however, "the novel" was an accepted form of literary art. In "*The Vicar of Wakefield*," Goldsmith adopted a method which he found ready-made to his hand, but used it with so much art, wit, and invention, that his story has become a classic.

Before writing "*The Vicar of Wakefield*," Goldsmith had employed himself in other departments of letters. His life

altogether had been strange and varied. He had studied medicine on the Continent, travelling about from city to city in a shiftless way, and spending in dissipation what little money he could earn. He had served as usher at a school at Peckham; had been a chemist's assistant, a physician with little or no practice, and a reader at Richardson's printing-office; and had finally taken to authorship—the usual refuge for the destitute when a man has abilities, and sometimes when he has none. This was about 1758, at which time Goldsmith was thirty years of age. Thenceforward, until his death in 1774, when he was not much beyond forty-five, his life was that of a toiling literary man, whose talents were almost equally divided between mere jobs for the booksellers, and the production of works, both in poetry and prose, which have proved their title to immortality. His lax habits, and his entire want of worldly knowledge and practical sense, kept him continually in difficulties, while his amiable nature, with its alloy of harmless vanity, endeared him to his friends. There are few pleasanter figures among the men of that time than Oliver Goldsmith; but it is impossible to regard him with any great respect.

It can be readily understood that a life of such varied experiences peculiarly qualified Goldsmith to shine as a novelist; yet the only novel he ever produced was "*The Vicar of Wakefield*." That celebrated work was written in 1762, and an interesting anecdote is told with respect to it. Dr. Johnson, always the faithful and attached friend of Goldsmith, one morning received a message from him, saying that he was in great distress, and begging him to call as soon as he was able. As the case was too obviously one of money, Johnson immediately sent him a guinea, and himself repaired soon afterwards to the needy author's lodgings. His landlady had arrested him for rent, and he was in a violent passion; but he had already changed the guinea for a bottle of Madeira. Johnson began to talk about his prospects, and the most feasible means for getting out of the existing difficulty. Goldsmith said he had a novel ready for the press, and put it in the hands of his friend, who looked into it, and saw at once the cleverness with which it was written. Telling the landlady he would soon return, he went to Newberry, the publisher, and persuaded him to purchase the manuscript for £60. Newberry, however, seems to have been in no hurry to print it, and it was not until 1766 that it appeared. Thus did "*The Vicar of Wakefield*" come into the world. It had Goldsmith for its author, and Johnson for its patron.

This delightful story of old English country life is secure of a permanent place in our national literature; but it may be doubted whether it is read as much by the present generation as it was even fifty years ago. The highly-wrought and stimulating character of modern fiction has put us out of taste for the quiet and somewhat prim manner of Goldsmith's novel. People say it is old-fashioned, and so indeed it is; at the same time, it is not sufficiently antiquated to have acquired the picturesqueness which belongs to the Middle Ages, or to the reign of Elizabeth. To the ordinary modern reader, it is a little discouraging to find a novelist prefacing his story by such sentences as these:—"The hero in this piece unites in himself the three greatest characters upon earth: he is a priest, a husbandman, and the father of a family. He is drawn as ready to teach, and ready to obey—as simple in affluence, and majestic in adversity. In this age of opulence and refinement, how can such a character please? Such as are fond of high life will turn with disdain from the simplicity of his country fireside," &c. It is not to be denied that a good deal of "*The Vicar of Wakefield*" is couched in this style, and it is a style no longer relished by English people. We have grown distrustful of the didactic, and require a vivid drama of life, passion, and action, which shall be left to work out its own moral, if, indeed, we seek a moral at all. This distrust of formal moralising, so characteristic of our age, is doubtless at the bottom of the increasing reluctance of readers to do more than admire Goldsmith's great production at a distance. An injustice is thus committed, and the public lose the delight and instruction of a work of genius which has a truth of its own, despite the few conventionalities with which it is overlaid. The charm of "*The Vicar of Wakefield*" has been felt and acknowledged by thousands, and it is a charm that will not decay. The humour is of the finest kind; the observation of life, broad, general, and tolerant; the criticism of human motives, such as one

might expect from a man who had seen a great deal of the world, yet who had retained his geniality and his benevolence. The story of Dr. Primrose and his family has furnished many commonplaces to the language; and Hazlitt has remarked that we are the better for the well-known allusion to the guinea which the two Miss Primroses kept unchanged in their pockets,—for being told about the picture of the vicar's family and that of the Flamborough family, the latter all painted with oranges in their hands,—and for the adventure of the gross of green spectacles. Another of the charms which even the least critical perceive in "The Vicar of Wakefield" is the beauty of the style. On analysis, this proves to be a curious compound of Addison and Johnson; yet the two elements are mingled with an art which belongs to Goldsmith himself. The somewhat forced and self-conscious simplicity of the vicar reminds us of Sir Roger de Coverley; his axiomatic sentences are manifestly caught from the Rambler.

LESSONS IN ALGEBRA.—V.

MULTIPLICATION.

66. EXAMPLES.—(1.) What will 4 oranges cost at x pence each?

Here we say, if one orange costs x pence, 4 oranges will cost 4 times as much; they will therefore cost $4x$ pence; and this is the answer.

(2.) How much can a man earn in 5 months at a pounds per month? Reasoning as before, we have $a \times 5 = 5a$ pounds for the answer.

Now $4x$ is equal to $x + x + x + x$; and $5a = a + a + a + a + a$.

67. Hence the repeated addition of a quantity to itself is called MULTIPLICATION. From this definition of multiplication, it is manifest that the product is a quantity of the same kind as the multiplicand.

68. It is plain, therefore, that multiplying by a whole number is taking the multiplicand as many times as there are units in the multiplier. Thus multiplying a by 1, is taking the multiplicand once, as a .

Multiplying a by 2, is taking the multiplicand twice, as $a + a$, etc.

69. On the other hand, multiplying by a FRACTION is taking a certain PORTION of the multiplicand as many times as there are like portions of a unit in the multiplier. Thus:—

Multiplying a by $\frac{1}{2}$, is taking $\frac{1}{2}$ of the multiplicand once, as $\frac{1}{2}a$.

Multiplying a by $\frac{2}{2}$, is taking $\frac{1}{2}$ of the multiplicand twice, as $\frac{1}{2}a + \frac{1}{2}a$.

70. Multiplying two or more letters together, is writing them one after the other, either with or without the sign of multiplication between them [see Art. 23, page 21]. Thus b multiplied into c is $b \times c$, or $b \cdot c$, or bc ; and the product of x into y , into z , is $x \times y \times z$, or $x \cdot y \cdot z$, or, as it is more commonly written, xyz . Also the product of am into xy is $amxy$; and of abc into xyz , is $abcxyz$.

71. There will be no difference as to the result in whatsoever order the letters are arranged. Thus the product of ba is the same as that of ab ; and 3 times 5 is equal to 5 times 3. In like manner, the product of a, b , and c , is abc, cab, bac , or cba . It is more convenient, however, to place the letters in alphabetical order.

72. When the letters have numerical CO-EFFICIENTS, these must be multiplied together, and prefixed to the product of the letters.

EXAMPLES.—(1.) Multiply $3a$ into $2b$.

Here the answer is $6ab$. For if a into b is ab , then 3 times a into b is evidently $3ab$; and if, instead of multiplying by b , we multiply by twice b , the product must be twice as great, that is $2 \times 3ab$, which is $6ab$.

(2.) Multiply $12hy$ (3.) $3dh$ (4.) $2ad$ (5.) $7bdh$ (6.) $3ay$
By $2xz$ my $13ghm$ x $8mz$

Product: $24hxyz$ $3dhmy$ $26adghm$ $7bdhx$ $24amay$

73. If either of the factors consist of figures only, these must be multiplied into the co-efficient of the other factor, and the letters annexed. Thus $3ab$ into 4, is $12ab$; $3b$ into $2x$, is $72x$; and 24 into hy , is $24hy$.

From the preceding rules we have the general one, that when

factors are to be multiplied, the product will be the same in whatever order the operation is performed.

74. If the multiplicand be a compound quantity, each of its terms must be multiplied into the multiplier. Thus the product of $b + c + d$ into a , is $ab + ac + ad$. For the whole of the multiplicand is to be taken as many times as there are units in the multiplier.

EXAMPLES.

(1.) Multiply $d + 2xy$ (2.) $2h + m$ (3.) $3hl + 1$ (4.) $2hm + 3$
By $3b$ $6dy$ my $4b$

Product: $3bd + 6bxy$ $12dhy + 6dmy$ $3hlm + my$ $8bhm + 12b$

75. It must be carefully observed that the preceding instances are not to be confounded with those in which several factors are connected by the sign $\times$, or by a point. In the latter case, the multiplier is to be written before the other factors without being repeated. The product of $b \times d$ into a , is $ab \times d$, and not $ab \times ad$; for $b \times d$ is bd , and this into a is abd [Art. 70]. The expression $b \times d$ is not to be considered like $b + d$, a compound quantity consisting of two terms. Different terms are always separated by $+$ or $-$ [Art. 19]. The product of $b \times h \times m \times y$ into a , is $a \times b \times h \times m \times y$, or $abhmxy$. But $b + h + m + y$ into a is $ab + ah + am + ay$.

76. If both the factors are compound quantities, each term in the multiplier must be multiplied into each term in the multiplicand. Thus $(a + b)$ into $(c + d)$ is $ac + ad + bc + bd$. For the units in the multiplier $a + b$, are equal to the units in a , added to the units in b . Therefore the product produced by a must be added to the product produced by b . Whence, the product of $c + d$ into $a + b$, is $ac + ad + bc + bd$.

For the product of $c + d$ into a is $ac + ad$; and the product of $c + d$ into b is $bc + bd$ [Art. 75]; therefore the product of $c + d$ into $a + b$ is $ac + ad + bc + bd$.

EXAMPLES.

(1.) Multiply $3x + d$ (2.) $4ay + 2b$
By $2a + hm$ $3c + rz$

Product: $6ax + 2ad + 3hmx + dhm$ $12acy + 6bc + 4arxy + 2brz$

(3.) Multiply $a + 1$ (4.) $2b + 7$
By $3x + 4$ $6d + 1$

Product: $3ax + 3x + 4a + 4$ $12bd + 42d + 2b + 7$

(5.) Multiply $d + rz + h$ by $6m + 4 + 7y$. Ans. $6dm + 6mrz + 6hm + 4d + 4rz + 4h + 7dy + 7ry + 7hy$.

(6.) Multiply $7 + 6b + ad$ by $3r + 4 + 2h$. Ans. $21r + 18br + 3adr + 28 + 24b + 4ad + 14h + 12bh + 2adh$.

77. When several terms in the product are alike, it will be expedient to set one under the other, and then unite them by the rules for reduction in addition, as in the following examples:—

(1.) Multiply $b + a$ (2.) $b + c + 2$
By $b + a$ $b + c + 3$

$bb + ab$ $bb + bc + 2b$
 $+ ab + aa$ $+ bc + cc + 2c$

Product: $bb + 2ab + aa$ $+ 3b + 3c + 6$

$bb + 2bc + 5b + cc + 5c + 6$

(3.) Multiply $a + y + 1$
By $3b + 2x + 7$

$3ab + 3by + 3b$
 $+ 2ax + 2xy + 2x$
 $+ 7a + 7y + 7$

Product: $3ab + 3by + 3b + 2ax + 2xy + 2x + 7a + 7y + 7$

(4.) Multiply $3a + d + 4$ by $2a + 3d + 1$. Ans. $6a^2 + 11ad + 11a + 3d^2 + 13d + 4$.

(5.) Multiply $b + cd + 2$ by $3b + 4cd + 7$. Ans. $3b^2 + 7bcd + 13b + 4c^2d^2 + 15cd + 14$.

(6.) Multiply $3b + 2x + h$ by $a \times d \times 2x$. Ans. $6abdx + 4adx^2 + 2adhx$.

78. It is plain that when the multiplier and multiplicand consist of any quantity, repeated as a factor, this factor will be repeated in the product as many times as it is in the multiplier and multiplicand together.

EXAMPLE.—Multiply $a \times a \times a$

By $a \times a$

Product: $a \times a \times a \times a \times a = aaaaa$, or a^5 .

Here a is repeated three times as a factor in the multiplicand, and twice in the multiplier; hence, it is repeated five times in the product, and is called the fifth power of a .

EXAMPLES.—(1.) What is the product of $bbbb$ by bbb ? Ans. $bbbbbbb$, or b^7 .

(2.) What is the product of $aa \times aaa \times aaaa$ by $aaa \times aaaa$? Ans. $aaaaaaaaaaaaaa$, or a^{16} .

79. It is also plain, from Art. 73, that the numeral co-efficients of several factors should be brought together and made into one factor by multiplication. Thus to multiply $2a \times 3b$ by $4a \times 5b$, gives the product of $2a \times 3b \times 4a \times 5b$, or $120aabb$; For the co-efficients are factors [Art. 24], and it is immaterial in what order these are arranged. Therefore $2a \times 3b \times 4a \times 5b = 2 \times 3 \times 4 \times 5 \times a \times a \times b \times b = 120aabb$.

EXAMPLES.—(1.) What is the product of $3x \times 4x \times 5y$ by $2y \times 4z$? Ans. $480xyz$.

(2.) What is the product of $3a \times 4b$ by $5m \times 6y$? Ans. $360abmy$.

(3.) What is the product of $4b \times 6d$ by $2x + 1$? Ans. $48bdx + 24bd$.

80. The product of two or more powers of the same quantity is expressed by writing that quantity with an index equal to the SUM of the indices of the proposed powers. Thus the product of a^2 and a^3 is a^5 ; and the continual product of a^2, a^4 , and a^6 is a^{12} . So likewise the product of x^m and x^n is x^{m+n} , and that of x and x^n is x^{n+1} ; and, on the same principle, the product of $x^m - a$ and x^n is $x^{m+n} - ax^n$. The reason of this is evident from Art. 79. Thus a^2 and a^3 are the same as aa and aaa ; the product of which is $aaaaa$ or a^5 ; the index 5 being the sum of the indices 2 and 3, the numbers which show how often a is used as a factor in the given powers.

EXAMPLES.—(1.) What is the product of a^2 and a^3 ? Ans. a^5 .

(2.) Find the continued product of a^2, ab , and a^4b^2 ? Ans. a^7b^3 .

(3.) Find the continued product of x^2, x^2y, x^4y^3 , and xy^4 . Ans. $x^{10}y^7$.

KEY TO EXERCISES IN LESSONS IN ALGEBRA.

EXERCISE 5.

- | | |
|--|--|
| 1. $2ab + 4xy + 10dfg$. | 15. $xx + 2bb$. |
| 2. $-25ax - 6ab - 7m$. | 16. $5my + 24aaa$. |
| 3. $-3ay - 21bx - 9bc$. | 17. $16(x + y) - 10(a + b)$. |
| 4. $2ab - 16xy - 4d$. | 18. $-13(a + b) - 52(x - y)$. |
| 5. $11a + 3x + 4df + 18xyz$. | 19. $a + 3aa + 7ba$. |
| 6. $17bc - 42xy + 23gh$. | 20. $x - 2xz - 11xxz$. |
| 7. $21ax + y + ac - ay - 4a + bc$
$- x + yz + dc$. | 21. $17 + 17x$. |
| 8. $21x + 40xy - 13a + 5bc - 10ab$
$- 4z$. | 22. $-7a - 33y$. |
| 9. $5xy - 29ab$. | 23. $5xy - 5ax + ay - my - 5z + 7dz$. |
| 10. $13ay - 2xz$. | 24. $87a$. |
| 11. $a + b + c + d - f + g - h - xy$. | 25. $4x^2z^3 - a^4 + b^4$. |
| 12. $13ab + 4xy - 6cd$. | 26. $8x^2y + 8xy^2$. |
| 13. $-(a - b + c + d - f - gh)$. | 27. $a^3 - 4a^4 + 11a^4$. |
| 14. $-(ab + cdx - df + x + y$
$- ghf + bc - xyz)$. | 28. $2a$. |
| | 29. $2a^3 + a^2x + 2ax^2 - x^3$. |
| | 30. $6x^2 + 2$. |
| | 31. $(a - c)x^2 + (b + d)x^2$. |

MECHANICS.—V.

PARALLEL FORCES.—CENTRE OF GRAVITY.

BEFORE proceeding to the subject of the Centre of Gravity, I must direct your attention to two consequences which flow directly from the principles established in the last lesson, and furnish the basis on which the properties of that centre rest. You have seen there that the centre of a system of parallel forces is found by cutting in succession certain lines which join certain points in certain definite proportions, namely, inversely as the forces acting at their extremities. Now, such cutting can give for each line, and therefore for all, as final result, only one point. For example, the centre of two parallel forces of six and four pounds acting at two points, A, B, of a body, as in the last lesson, is got by dividing A B into ten parts, and counting off four parts next to A, or six to B, and the result evidently can be only one point. If we now suppose a third parallel force of five pounds added, acting at some other point C, of the body, and join the point last found with C, and divide the joining line into fifteen parts, taking ten next to C, here again only one point is the result. And so on for any number of forces it can be shown that there is but one centre.

But, lest it should be thought possible that, on cutting these lines in a different order of the points, A, B, C, etc., a second centre should turn up, let us think that possible, and apply forces at these points parallel to each other, but not parallel to the line joining these two centres. Their resultant then passes through both of these points, and therefore must act in the line joining them, which is impossible; since, as I have proved, it must be parallel to its components.

Furthermore, you will observe that all these lines are cut only in reference to the magnitudes of the forces; no account is taken of their direction. Whether they pull upwards or downwards, or obliquely to left or to right, so long as the magnitudes remain the same, or even keep the same proportion—say that of six, four, and five—the centre cannot change. Of course, the points are supposed not to change. Whatever be the number of points and forces this is true; as for three, so for any other number. And mark, moreover, that it makes no difference how this change of direction is produced, whether, leaving the body in one fixed position, you make the forces change directions as at A and B (Fig. 17), or, preserving the direction, you turn the body round, as from A to C in the same Fig. In neither case does the centre change. These results may be summed up in the two following propositions:—

1. A System of Parallel Forces acting at given points in a body, has ONE Centre of Parallel Forces, and only one.

2. The Centre of Parallel Forces does not change its position when the direction of the forces is changed in reference to the body.

THE CENTRE OF GRAVITY.

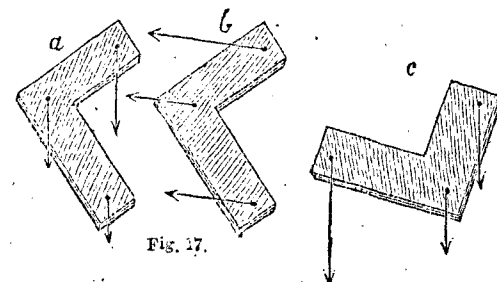
The centre of gravity is the particular case of the centre we have been last considering, in which the forces are those by which bodies on the earth's surface are drawn by attraction towards its centre. The smallest body, particle, or atom, is drawn in proportion to its mass, equally with the largest; and it is to the tendency of these bodies so to move downwards in obedience to this attraction, that we give the name of "weight." The term "gravity" carries a similar meaning, being derived from the Latin *gravis*, heavy.

Now, since every particle of matter is thus drawn to the earth's centre, it is evident that the weight of all large masses, such as a block of marble, beam of timber, or girder of iron, is the joint effect, or the resultant, of the attractions of the separate atoms. But these attractions are all so many parallel forces; for, pulling, as they do, towards the earth's centre, which is nearly 4,000 miles away down in the ground, they incline, even in the largest objects, so little towards one another that practically they may be considered not to meet, that is, to be parallel. Hence you see that all the principles we have proved about parallel forces hold good of the earth's attraction of these atoms, and that we may affirm that—

1. A body has one Centre of Gravity, and only one.

2. The Centre of Gravity is not changed by the body being turned round after any manner in any direction.

It thus appears that the weights of all the separate atoms of any mass of matter are equal to a single weight supposed to act at some point within that mass, or, as sometimes happens (and we shall see), even without, equal to their sum. There is great



advantage in this simplification; for, instead of having to consider millions of diminutive forces acting at all its points, we direct our attention to only one force, acting at only one point.

You can now understand how it is that a piece of card or thin board may be supported on the point of a rod, wire, or needle. All that is necessary is to bring the point under the centre of gravity of the board; then, the resultant of all the forces by which its several parts are pulled downwards passing through that centre, will be resisted by the rod, and there will be equilibrium; the card will be *balanced*.

Another consequence follows. Let the body be of any shape, regular or irregular; and suppose that, having determined its centre of gravity, we fix or support that point in some way so that the body may freely turn round it, as on a pivot, in every direction. Then, since, as I have shown, the centre of gravity cannot change as the body turns round, whatever position I place it in, the centre remains supported, and the resultant weight, $G P$, passing through it, will be resisted by its supports, and the body will be in equilibrium, as in Fig. 18, where G is the supported centre of gravity.

Now suppose that instead of this centre we make the body pivot round some other one of its points, O (as in Fig. 19). Then, if I place it so in the position $O A B$, that the centre of gravity, G , may lie exactly under O , as a plumb-line would hang, the weight acting along the line, $O G$, may be taken to have O for its point of application, by which, as it is fixed, it will be resisted. In such case there will be equilibrium, G being under

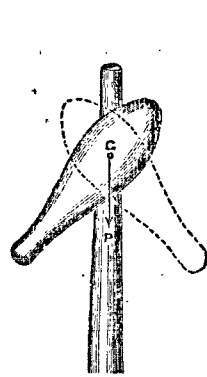


Fig. 18.

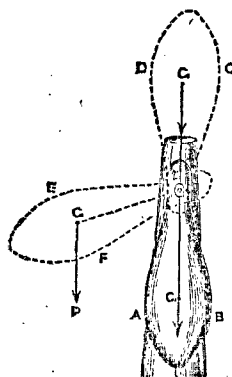


Fig. 19.

O . And so, also, if G were exactly above O , as in $O C D$, in the vertical line produced upwards, the weight would press downwards on O , and be there resisted. But if I put it in any other position, $O E F$, where G will not be either above or below O , the weight acting downwards, in the direction $G P$, will not be opposite to the line $O G$ of resistance of O , and there cannot be equilibrium. There are thus two positions in which the body may be at rest, both on the vertical line through O ; but one in the *lowest* position it can attain and the other in the *highest*. We thus learn that—

1. If a body be suspended by or supported at its centre of gravity, it will be at rest, whatever be the position in which it is placed.

2. If the body be suspended by or supported at any other point, it will be at rest when the centre of gravity is in its highest or lowest possible position on the vertical line through the point of suspension or support.

If two points A, B (Fig. 20), are fixed, all the points of the line $A B$ are fixed, but the body is free to turn round that line; and if in that case the centre of gravity is somewhere on $A B$, as G , it also is fixed, and the weight there concentrated will be borne by the two points of support, $A B$, divided between them in two portions inversely proportional to their distances, $A G, B G$, from the centre of gravity. The body will, therefore, be in equilibrium in every position into which it can be turned round the line $A B$. But if, when two points are fixed, this centre is not on the line $A B$, it is free to move round it. There

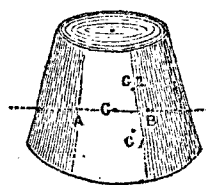


Fig. 20.

are, therefore, two positions, G_1, G_2 , in a plane vertically passing through this line—one below, the other above, in which it may rest, and the result is similar to that stated in the above propositions. Familiar examples of this are furnished by all pieces of machinery in which bodies move round fixed axes, such as the fly-wheel of a steam-engine, or the smaller wheels round which the bands pass, which set the printing presses at work in the machine-room—all the points along the line which runs down the centre of the axle are at rest. A trap-door, which opens both downwards and upwards, is another instance; in that case the centre of gravity is under or above the axle-line of the hinges when the door hangs in equilibrium.

But bodies may be kept in equilibrium in other ways than that of fixing points within their substance. A horse poised in the air, as it is about to be lifted into a transport ship, by a rope which descends from the top of a crane and is attached to a belt which goes round his body, is an instance. Here the centre of gravity of the lifted animal is under the point of support and on the line of direction of the rope which transmits its weight to the crane above. But observe, in this case, there is only one position of equilibrium—namely, the lowest. The rope not being rigid, you cannot wheel the horse half round, heels up in the air (Fig. 21) until he reaches the highest position the chain would allow him to reach, and make his weight thence press downwards on the crane. To do this a rigid bar should take the place of the rope.

But bodies are most commonly kept at rest by being supported from below by the earth, either on the ground itself, or on some floor, table, etc. What conditions will secure a steady equilibrium? First, there must be some base or bottom to the body on which it may rest, such as the bottom of a teapot or candlestick. Secondly, it must be broad enough to keep the body steady, to prevent its upsetting or rocking. A candlestick resting on the socket into which the candle is put, would soon overturn, and the slightest touch would set an egg rocking.

Now, in order to ascertain the equilibrium and stability of bodies so placed, let us suppose two of the forms in Fig. 22 to rest on a level table, touching it on the two perfectly flat bases $x y z, x_1 y_1 z_1$, there represented. Let G be the centre of gravity of that to the right, and $G P$ the perpendicular to the table through that point. Let, moreover, G_1 and $G_1 P_1$ be the corresponding centre and perpendicular of the body to the left. Now, since the table, by its resistance distributed equally over the base $x y z$ of the first body, prevents its moving downwards, and this resistance at every point is perpendicular to the floor, these resistances, taken together, are a system of parallel forces, and have a parallel centre somewhere in that base. Let this centre be O . Join now $O P$; and, as the same reasoning holds good of the body to the left, let $O_1 P_1$ be the corresponding line in it. Moreover, let x, x_1 be the points in which the lines $O P, O_1 P_1$ cut the circumference, or boundary of the bases $x y z, x_1 y_1 z_1$. The body to the right is thus acted on by two forces; the resistance at O upwards supporting it, and the weight at G pulling downwards. But, as the point P falls, in this case, outside the base $x y z$, there is nothing to prevent the body obeying it by turning over on its edge at x .

But, in the other case, where P_1 is within the base, the weight at G_1 tends to make the body fall inwards, turning on its edge at x_1 .

But, in the other case, where P_1 is within the base, the weight at G_1 tends to make the body fall inwards, turning on its edge at x_1 .

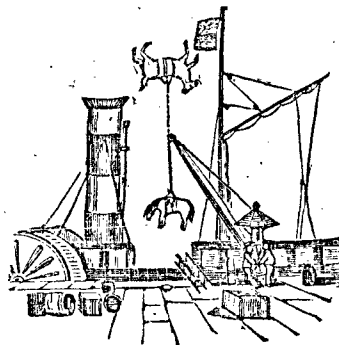


Fig. 21.

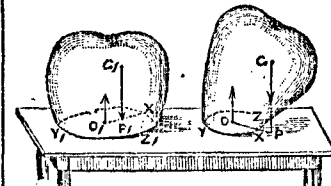


Fig. 22.

at x_1 . But then, there is the resistance of the table at O_1 , acting upwards to prevent that motion; and consequently the body remains at rest, or is in equilibrium.

And this statement holds equally good when the plane on which the body rests is sloped or inclined to the horizontal plane; as is evident from Fig. 23, where the cylindrical body on the slope $A B$ must upset if $G P$ falls outside the base $x y z$. We may, therefore, conclude generally both as to horizontal and inclined planes that a body will rest in equilibrium on a plane, if the vertical line, passing through its centre of gravity, meets the plane within the base. If it meets it outside the base, the body will overturn.

Between these two, it should be observed that there is an intermediate case, in which the perpendicular meets the plane neither within nor without the base, but on its circumference. When this happens, the body is equally disposed to stand or upset; but, in fact, it will overturn; for in such an unsteady position the slightest touch or shake would send it over. It is a case of *unstable equilibrium*.

In interpreting and applying this principle to practice, you must be on your guard as to the meaning of the word "base;" else you may imagine some day you have discovered that a body does not upset when the vertical from the centre of gravity falls outside the base. Suppose the base to be bent inwards into a horse-shoe form, as in the cone, a (Fig. 24), or into the form of the semi-circular wall, b , in which latter case the centre of gravity is within the substance of the body; then the point P is on the floor, outside the spaces along which the bodies are in contact with it. Still, neither body will upset; for the advanced spurs of the bases at y and z will act as

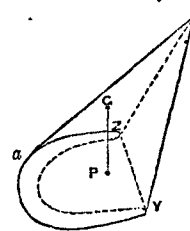


Fig. 24.

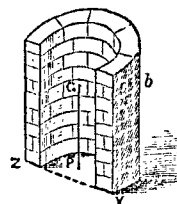
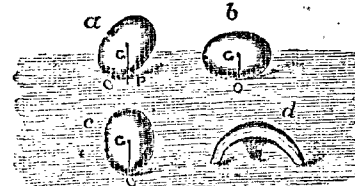


Fig. 25.

props, and in order to upset they must turn over the line $z z$ joining them. This shows that the real base includes all the open space within $x y z$; and you learn that, whenever the base of contact bends inwards, you must measure the base of support from one projecting point to another all round, making no account whatever of the inward bends. A common table touches the floor only at four points, and a round table at three; but in both the base of support is all the space within the oblong or triangle got by joining these points.

There is another class of cases to be noticed, those which are round all over their surface like a ball, or egg, or sea-shore pebble, and have no flat bases to rest on—that is, which can be supported at only one point of their surface; or, where there are hollows on them, along a line of points surrounding the hollow. This latter case we need not consider, for such bodies rest, like those we have already examined, so far as the hollows are concerned (as in d , Fig. 25), on wide bases.

Confining attention, therefore, to cases in which there are no hollows, or the surface is *convex all round*, if you place such a body, say an oval, in the position represented at a (Fig. 25), the perpendicular, $G P$, from its centre of gravity, G , on the plane will fall outside its base, or point of support, O , and it will roll over until, after rocking for a few turns, it settles into the position b , in which G is above O . Now move it further from this until



it reaches the position c , in which again G will be over the point of support, O ; and again you will have a *possible equilibrium*, that is, possible in imagination, for the body is supported from below. But *actually* to produce equilibrium in this case is the celebrated problem of Columbus, which that great navigator solved after so summary a fashion. So *unsteady* is it, that the body drops immediately into the position b .

Of this unsteady, or unstable equilibrium, we shall have more in the next lesson; my object here is to point out the fact that in both positions, b and c , the line $G O$ is perpendicular to the surface of the body. It is evidently perpendicular to the plane on which the oval rests; but, since the latter's surface touches, or coincides at O , with that plane, $G O$ must be perpendicular also to that surface. Hence we learn that, whatever be the number of points at which a *convex* body can rest, steady or unsteady, on a horizontal plane, for every one of these points the lines connecting them with the centre of gravity must pierce its surface at right angles; or—

The number of positions of equilibrium of a *convex* body, supported on a horizontal plane, is equal to that of the *perpendiculars* to its surface which can be drawn from its centre of gravity.

A few instances in illustration of the principles explained in this lesson will now be useful. When a man stands upright, the base by which he is supported is so much ground under him as is covered by his feet, together with the space between them. If he widens that space to left and right, he makes himself more steady as to being thrown sideways, but is more easily cast on his face. If he puts one foot before the other, he becomes steadier at front and back, but less so to his sides. A two-wheeled gig, or Hansom, to be properly balanced, should have its centre of gravity over the line joining the points at which the wheels touch the ground. If it be in advance of that line, it will throw a weight on the horse's back; if behind it, the gig will upset backwards should the belly-band break.

A body may be made to roll up an incline by loading it at one side. Take a round ball of cork, for instance, and put some lead into a hollow scooped out near its surface, closing the hole so as to leave the ball perfectly round. The centre of gravity will then no longer be at the centre of the ball, but to one side, let it be at c (in c , Fig. 26). Put the ball now on the incline, with the loaded side looking up the slope; the perpendicular $G P$ will meet the incline above O , and the ball will continue to roll upwards until the centre of gravity, G , comes over the point of support.

This experiment may be tried in another form without the use of the lead, by simply scooping a hollow on one side, or as in the following example:—Get a round cylinder of cork—a common bottle cork—and scoop out its substance on one side, as represented at b , Fig. 26, preserving carefully the roundness of the two circular faces at its ends. Put this cylinder on the incline, with the scooped part facing down the slope, and you will find that it will also run upwards, as did the ball. The reason of this you will easily discover, but one word of caution may be given: be careful, in making the experiment, that the incline be not great.

The following are other common instances of the principles enunciated, which you can try as

EXAMPLES FOR PRACTICE.

1. A man walking up a hill stoops forward; why? And why, also, when coming down, does he lean backward?
2. A person rising from a chair leans his body forwards, and draws his feet close to the chair; why?
3. Carrying a bucket of water with one hand, he leans to the side opposite.
4. Why does a corpulent person generally hold his head up and throw his shoulders backward?
5. A horse and rider are more apt to fall coming down a hill than on the level road; why?
6. An omnibus, or coach, is safer for travelling when it is well filled inside, than when outside.

ANSWERS TO THE QUESTIONS IN LESSON III.

Polygon of Forces.

1. The resultant is a little over 13 lbs., and makes an angle of nearly 45° degrees with the force *o* *a*.
2. The force which supports the roller on the slope is 56 lbs., and the pressure 97 lbs. nearly.
3. The strain on the three-foot cord is 43 lbs., and on the four-foot cord 36 lbs.
4. The point of meeting of the three cords is below the pulleys, at the distance of six feet from the top of that over which the 4 lb. weight hangs, and of 8 feet from the top of the other pulley.

LESSONS IN GREEK.—XVII.

COMPARISON OF ADJECTIVES (continued).

ADJECTIVES IN -ων (or -ων) AND -ιστος.

THESE forms are taken by ἡδύς, sweet, and ταχύς, swift, the termination -us being removed; ταχύς, however, has in the comparative βαττων (βασσών is another form of the same word), thus:—

Positive.	Comparative.	Superlative.
ἡδ-υς.	δ, ἡ ἡδ-ων.	το ἡδ-ιστος.
ταχ-υς.	βαττων.	ταχ-ιστος.

The other adjectives in -us—as βαρύς, heavy; βαθύς, deep; βραχύς, short; δατύς, thick; ευρύς, broad; οξύς, sharp; πρεσβύς, old; ὠκύς, swift—take the forms in -τερος, -τατος, thus:—

Positive.	Comparative.	Superlative.
δ βαδ-υς.	το βαδ-ων.	το βαδ-ιστος.

The forms -ων and -ιστος are taken also by two adjectives ending in -ρος, namely, αἰσχυρός, hateful, shameful, and ἐχθρός, hostile; the termination -ος being cut off; as—

Positive.	Comparative.	Superlative.
αἰσχ-ρος.	δ, ἡ αἰσχ-ων.	το αἰσχ-ιστος.

VOCABULARY.

Αλλοί, -αι, -α, others.	Μεταφεράω, I bear away, change.	Παρεχάω, I afford, communicate; (middle voice), yield, give.
Ζῶν, to, a living being, an animal.	Οἱ ἀκρατεῖς, the intemperate.	Πραγμα, -άτος, to, a deed, thing.
Καίρος, -ου, δ, season, time generally.	Ὁσμή, -ης, ἡ, smell.	
Λοίπος, -η, -ον, the remainder, the rest.	Ὀφίς, -εως, δ, a serpent.	

EXERCISE 57.—GREEK-ENGLISH.

1. Ὁ βαθύτατος ὕπνος ἡδίστος ἐστίν. 2. Πολλὰ ἀνθ' ἡδίστην οὐκ ἀντιπαρέρχεται. 3. Οὐδὲν βαττων ἐστὶ τῆς ἡδύς. 4. Τὴν αἰσχυρὴν δουλείαν οἱ ἀκρατεῖς δουλεύουσιν. 5. Πάντων ἡδίστον ἐστὶν ἡ φιλία. 6. Οὐδὲν αἰσχίον ἐστὶν ἢ ἄλλο μὲν ἐν νῷ εἶναι, ἄλλο δὲ λέγειν (to think one thing and say another). 7. Οἱ οφείεις τοῖς λοιποῖς ζωὴς ἐχθιστοὶ εἰσιν. 8. Οὐδὲν τῷ ἀνθρώπῳ ἐχθίον ἐστὶν ἢ ὁ ἀνθρώπος. 9. Ταχίστα δὲ καὶρος μεταφέρει τὰ πράγματα.

EXERCISE 58.—ENGLISH-GREEK.

1. Nothing is sweeter than deep sleep. 2. Sleep is very sweet. 3. Nothing is more disgraceful than slavery. 4. Slavery is a very bitter thing. 5. Horses are very swift. 6. Nothing is more hostile (unfriendly) than bad advice. 7. It is shameful to think one thing and say another. 8. Bad men think one thing and say another. 9. Nothing is sweeter than a faithful friend.

A number of adjectives not being reducible to either of these forms, are called irregular. I subjoin a list of

ADJECTIVES OF IRREGULAR COMPARISON.

1. αγαθος, good	αμεινων, N. αμεινον	αριστος, -η, -ον.
	βελτιων	βελτιστος
	κρειττων (κρεισσων)	κρατιστος
	λαφων	λαφιστος
2. κακος, bad	κακιων	κακιστος
	χειρων	χειριστος
	ηττων (ησσων), inferior	ηκιστα (adv.)
3. καλος, beautiful	καλλιων	καλλιστος
4. αλγεινος, painful	αλγεινότερος	αλγεινοτατος
	αλγιων	αλγιωτατος
5. μακρος, long	μακροτερος	μακροτατος
	μασσων	μηκιστος

6. μικρος, small	μικροτερος	μικροτατος, -η, -ον.
	ελαττων (ελασσων)	ελαχιστος
7. ολιγος, few	μειων	ολιγιστος
8. μεγας, great	μειζων	μεγιστος
9. πολυς, much	πλειων (πλειων)	πλειστος
10. ραδιος, easy	ρῶων	ραπτος
11. πεπων, ripe	πεπαιτερος	πεπαιτατος
12. πικρ, fat	πιότερος	πιότατος

Several adjectives which express the idea of order or succession appear in the comparative and superlative only, since from their import they cannot denote an absolute quality, and may be used only in comparison. Their root will be found in a preposition, or adverb of place; for example—

ADJECTIVES WITHOUT A POSITIVE.

From προ, before,	πρότερος, prior,	πρώτος, first.
From ανα, up,	ανώτερος, upper,	ανώτατος, upmost.
From υπερ, over,	υπερτερος, higher,	υπερτατος, highest.
From υπο, under	υστερος, posterior,	υστατος, most behind.
From εξ, from,	εσχάτος, last, most from, most remote.	
From πλησιον, near, in	πλησιαιτερος, nearer,	πλησιαιτατος, nearest.
From προω, forwards,	προσωτερος, further,	προσωτατος, furthest.
		more in advance,

VOCABULARY.

Αναγκαιος, -α, -ον, necessary.	Εμφυτος, -ον, in-born.	Μαλακος, -η, -ον, soft.
Αναγκη, -ης, ἡ, necessity.	Ενιοτε, sometimes.	Μετρον, -ου, το, measure, moderation.
Αναρχια, -ας, ἡ, absence of government, anarchy.	Ευτυχης, -ες, fortunate.	Σκωπτω, I jeer.
Γειτων, -ονος, δ, a neighbour.	Η, η, either, or.	Στεργω, I love, I am satisfied with, I put up with.
Ελευθερος, -α, -ον, free.	Ιβηρια, -ας, ἡ, Spain.	Συμβουλος, -ου, δ, an adviser.
	Ισχυω, I am strong.	Σωφροσυνη, -ης, ἡ, sound-mindedness.
	Κελευα, I order.	
	Κολακεια, -ας, ἡ, flattery.	

As, with a superlative, adds strength to it, as quā in Latin; for example, ὡς ταχίστος, quā celerissimus, as swift as possible.

EXERCISE 59.—GREEK-ENGLISH.

1. Οὐχ ὁ μακροτατος βίος ἀριστος ἐστίν, ἀλλὰ ὁ σπουδαιότατος. 2. Μετρον ἐπὶ πάντων ἀριστον (understand ἐστίν). 3. Γινώμει των γεωμετρῶν ἀμεινους εἰσιν. 4. Συμβουλος οὐδεὶς ἐστὶ βελτιων χρονον. 5. Η λέγει σιγῆς κρειττονα, ἢ σιγῆν εχει. 6. Αἰ κρατιστον ἐστὶ το ἀσφαλεστατον. 7. Σκωπτεις, ὦ λῆρτε. 8. Βελτιωνων κακιους ἐνιοτε ευτυχστεροι εἰσιν. 9. Οὐκ ἐστὶ λυπη χειρον ἀνθρώπων κακον. 10. Κολακεια των ἀλλων ἀπάντων κακων χειριστον ἐστίν. 11. Ανηρ μαλακος τὴν ψυχην (as to his soul, mind) καὶ (even) χρημάτων ἦν. 12. Ταῖς γυναιξὶν ἡ σωφροσυνη καλλιστη ἀρετη ἐστίν. 13. Οὐκ ἐστὶ κτημα καλλιον φιλον. 14. Ἡ δουλεια τῷ ελευθερῷ ἀλγιστη ἐστίν. 15. Ἡ ὁδος μηκιστη ἐστίν. 16. Ὁ κροκοδειλος ἐξ ἐλαχιστου γινεται μεγιστος. 17. Ἡ γῆ ἐλαττων ἐστὶ τοῦ ἡλιου. 18. Στεργε καὶ τὰ μειω. 19. Ολιγιστοι ἀνθρωποι ευδαιμονες εἰσιν. 20. Ουδεὶς νομος ισχυει μειζον της ἀναγκης. 21. Μικρα κερδη πολλakis μειζονας βλαβας φερει. 22. Ἀναρχιας μειζον οὐκ ἐστὶ κακον. 23. Ὁ πολεμος πλειστα κακα φερει. 24. Εμφυτος ἐστὶ τοῖς ἀνθρώποις ἡ τοῦ πλειονος επιθυμια. 25. Γυνη εσθλη πλειστα αγαθα τῷ οἴκῳ φερει. 26. Τα ἀναγκαια του βιου φερε ὡς ῥεστα (as easily as you can). 27. Το κελευεν ῥαον ἐστὶ τοῦ πραττειν. 28. Οἱ της σοφης καρποι πεπαιτατοι εἰσι. 29. Εν τῷ του πατρος κηπῷ οἱ της ἀμπελου βοτρυες πεπαιττοι εἰσιν, ἢ εν τῷ του γειτονος. 30. Ιβηρια τρεφει ποτατα προβατα.

EXERCISE 60.—ENGLISH-GREEK.

1. There is nothing better than a very diligent life. 2. The opinion of the ancients is very good. 3. Time is the best adviser. 4. The safest is the best. 5. Grief is a very great evil. 6. Nothing is worse than flattery. 7. The intemperate man is the slave of pleasures. 8. Women have nothing more beautiful than wisdom. 9. To a free man nothing is worse than slavery. 10. The crocodile is very long. 11. The son is less than the father. 12. The bad often have more property than the good. 13. War brings very great evils. 14. It is easy to command, it is hard to obey. 15. We enjoy most (superlative) the ripest fruits. 16. My father's sheep are fatter than those of (the article τα) his neighbour.

GENERAL VIEW OF THE TERMINATION OF ADJECTIVES.

In order to assist you in mastering the subject, I here put together the different terminations of adjectives. I add those of the participles, because the participle and the adjective are declined alike; remember that both adjective and participle are also declined like nouns of the same terminations. You will also call to mind that adjectives are divided into three classes: 1. those of three terminations; 2. those of two terminations; 3. those of one termination.

1. ADJECTIVES OF THREE TERMINATIONS.

	δ	ἡ	το
1. -ος, -η, -ον.	Nom. αγαθος, αγαθη, αγαθον, good.		
	Gen. αγαθου, αγαθης, αγαθου.		
	N. Plu. αγαθοι, αγαθαι, αγαθα.		
	Gen. αγαθων, αγαθων, αγαθων.		
	Nom. ογδοος, ογδοη, ογδοον, eight.		
	G. Plu. ογδων, ογδων, ογδων.		
	Nom. γραφομενος, γραφομενη, γραφομενον, written.		
	G. Plu. γραφομενων, γραφομενων, γραφομενων.		
-ος, -α, -ου.	Nom. δικαιος, δικαια, δικαιον, just.		
	Gen. δικαιου, δικαιας, δικαιου.		
	G. Plu. δικαιων, δικαιων, δικαιων.		
	Nom. εχθρος, εχθρα, εχθρον, hostile.		
	Gen. εχθρου, εχθρας, εχθρου.		
	Nom. αθροος, αθροα, αθροον, crowded, dense.		
	Gen. αθροου, αθροας, αθροου.		
	G. Plu. αθρων, αθρων, αθρων.		
Contracted Nom.	χρυσος, χρυσα, χρυσειον, golden.		
in -εος, -ου, -ου.	χρυσου, χρυση, χρυσειον, golden.		
-εα, -εου, -ου.	Gen. χρυσοι, χρυσαι, χρυσα.		
	Nom. χρυσοι, χρυσαι, χρυσα.		
	Gen. ερεος, ερεας, ερεον, woolly.		
	Gen. ερεος, ερεας, ερεον.		
2. in -υς, -ου, -ου.	Nom. γλυκος, γλυκεια, γλυκειον, sweet.		
	Gen. γλυκειου, γλυκειας, γλυκειου.		
	G. Plu. γλυκειων, γλυκειων, γλυκειων.		
3. in -υς, -ου, -ου.	Nom. δεικνυς, δεικνυσα, δεικνυον, showing.		
	Gen. δεικνυτος, δεικνυτης, δεικνυτος.		
	Nom. φυς, φυσα, φυν, born, arisen.		
	Gen. φυντος, φυσης, φυντος.		
4. in -εις, -ου, -ου.	Nom. χαριεις, χαριεσσα, χαριεν, graceful.		
	Gen. χαριεντος, χαριεσσης, χαριεντος.		
Contracted Nom.	τιμηεις, τιμηεσσα, τιμην, honoured.		
	Gen. τιμηεντος, τιμηεσσης, τιμηεντος.		
	Nom. μελιτοεις, μελιτοεσσα, μελιτοεν, honeyish.		
	Gen. μελιτου, μελιτουσσα, μελιτου.		
	Gen. μελιτουτος, μελιτουσσης, μελιτουτος.		
5. -εις, -ου, -ου.	Nom. λειφθεις, λειφθεσσα, λειφθεν, left.		
	Gen. λειφθεντος, λειφθεσσης, λειφθεντος.		
	Nom. τιθεις, τιθεισα, τιθεν, placing.		
	Gen. τιθεντος, τιθεισης, τιθεντος.		
6. -ας, -αινα, -αν.	Nom. μελας, μελαινα, μελαν, black.		
	Gen. μελανος, μελαινης, μελανος.		
7. -ας, -αα, -αν.	Nom. πας, πασα, παν, all, every.		
	Gen. παντος, πασης, παντος.		
	N. Plu. παντες, πασαι, παντα.		
	Gen. παντων, πασων, παντων.		
8. -ας, -αα, -αν.	Nom. λειψας, λειψατα, λειψαν, having left.		
	Gen. λειψαντος, λειψασης, λειψαντος.		
9. -ην, -εινα, -εν.	Nom. τερην, τερεινα, τερεν, terebinth.		
	Gen. τερενος, τερεινης, τερενος.		
10. -ους, -ου, -ου.	Nom. διδους, διδουσα, διδον, giving.		
	Gen. διδοντος, διδουσης, διδοντος.		
11. -ων, -ου, -ου.	Nom. εκων, εκουσα, εκον, willing.		
	Gen. εκοντος, εκουσης, εκοντος.		
12. -ων, -ου, -ου.	Nom. λειπων, λειπουσα, λειπον, leaving.		
	Gen. λειποντος, λειπουσης, λειποντος.		
Contracted Nom.	τιμων, τιμωσα, τιμων, honouring.		
	Gen. τιμωντος, τιμωσης, τιμωντος.		
	Nom. φιλων, φιλουσα, φιλον, loving.		
	Gen. φιλοντος, φιλουσης, φιλοντος.		
13. -ως, -υια, -ος.	Nom. τετυφως, τετυφια, τετυφος, having struck.		
	Gen. τετυφοτος, τετυφιας, τετυφοτος.		

2. ADJECTIVES OF TWO TERMINATIONS.

	δ, ἡ, το.	
1. -ος, -ον.	Nom. αλογος, αλογον, unreasonable.	
	Gen. αλογου.	
2. -ους, -ου.	Nom. ευνους, ευνου, well-disposed.	
	Gen. ευνου.	
3. -ως, -ων.	Nom. ιλεως, ιλεων, propitious.	
	Gen. ιλεω.	
4. -ων, -ον.	Nom. σωφρων, σωφρονος, sound-minded.	
	Gen. σωφρονος.	
5. -ης, -ες.	Nom. αληθης, αληθες, true.	
	Gen. αληθους.	
6. -ην, -εν.	Nom. αρην, αρηνος, male.	
	Gen. αρρενος.	
7. -ωρ, -ορ.	Nom. απατωρ, απατορ, fatherless.	
	Gen. απατορος.	
8. -ις, -ι.	Nom. ιδρις, ιδρι, expert.	
	Gen. ιδριος.	
9. -υς, -υ.	Nom. αδακρυς, αδακρυ, tearless.	
	Gen. αδακρυος.	
10. -ους, -ον.	Nom. μονοδους, μονοδον, having one tooth.	
	Gen. μονοδοντος.	

3. ADJECTIVES OF ONE TERMINATION.

	Gen.	Nom.	Gen.
1. -ας, -ον.	δ μονιας, μονιου, lonely.		
2. -ας, -αντος.	δ, ἡ ακαμας, ακαμαντος, unwearied.		
3. -ας, -αδος.	δ, ἡ φυγας, φυγαδος, fleeing, an exile.		
4. -αρ, -αρος.	δ, ἡ μακαρ, μακαρ, blessed.		
	ἡ μακαρια, μακαρια, blessed.		
5. -ης, -ου.	δ, ἡ εθελοντης, εθελοντου, willing, spontaneous.		
6. -ης, -ητος.	δ, ἡ αργης, αργητος, white.		
7. -ην, -ητος.	δ, ἡ απτην, απτηνος, unfeathered.		
8. -ως, -ωτος.	δ, ἡ αγνωος, αγνωτος, unknown.		
9. -ις, -ιδος.	δ, ἡ αναλκίς, αναλκιδος, powerless.		
10. -υς, -υδος.	δ, ἡ νεγλως, νεγλιδος, recently come.		
11. -ξ, -γος.	δ, ἡ αρπαξ, αρπαγος, plundering.		
	δ, ἡ ηλικ, ηλικος, of the same age.		
	δ, ἡ μωνυξ, μωνυχος, having one hoof.		

KEY TO EXERCISES IN LESSONS IN GREEK.—XVI.

EXERCISE 53.—GREEK-ENGLISH.

1. Aristides was very poor, but very just. 2. The Cyclops were not violent. 3. Callias was the richest of Athenians. 4. Nothing is more serviceable than silence. 5. Silence at times is preferable to speech. 6. Nothing is more honourable than wisdom. 7. Wisdom is a possession more honourable than wealth. 8. The Spartans' mode of living was the most simple. 9. The more aged exult in the honours of the young. 10. Fatherland is very dear to mankind. 11. The Indians are reckoned a very ancient race. 12. O children, be very quiet. 13. The Spartan young men were stronger than those of the Athenians. 14. Many are more garrulous than swallows. 15. Slaves are often very mendacious and very thievish.

EXERCISE 54.—ENGLISH-GREEK.

1. Ὁ πατήρ ἐστι σοφώτερος ὁ υἱός. 2. Ἡ μήτηρ ἐστὶν λαλίσταρα ἢ ἡ θυγάτηρ. 3. Ἡ ἀρετὴ ἐστὶ τιμιώτατον κτημα. 4. Σωκράτης ἦν σοφώτατος των ἀθηναίων. 5. Οἱ ἀθηναῖοι ἦσαν σοφώτεροι ἢ οἱ λαλισταί. 6. Ουδεὶς των παλαιων Ἑλλήνων σοφώτερος ἢ Ἀριστοτελης. 7. Ἄνδρες εἰσιν ἡσυχαιότεροι των παιδων. 8. Οἱ λακεδαιμονες ἦσαν ισχυροτατοι. 9. Αἱ χελιδνες εἰσι λαλισταται. 10. Ὁ κοραξ ἐστὶ κλεπτιστατος. 11. Ἡ διατα των Σωκρατων ἦν ἀπλουστατη.

EXERCISE 55.—GREEK-ENGLISH.

1. Youth passes by as suddenly as thought, nor is the impetuosity of horses more swift. 2. Old age is heavier than Etna. 3. Death is most like a very deep sleep. 4. Young men rejoice in the praises of old men. 5. The possession of a just friendship is very safe. 6. The mean in all things is safest. 7. Old men are weaker than young. 8. Nothing is safer than right counsel. 9. Crows are very black. 10. Socrates was most continent and temperate. 11. In misfortune men are more prudent than in good fortune. 12. Critias was most rapacious. 13. Aphrodite was the most graceful (or pleasant) of all the goddesses.

EXERCISE 56.—ENGLISH-GREEK.

1. Το γῆρας βαρύτερον ἐστὶ. 2. Ουδὲν ἐστὶ ἀκνότερον του νηπιου. 3. Ἡ μεσση ἐστὶν ἀσφαλεστατη. 4. Ουδεμία ορνις μελαντερα του κορακος. 5. Ὁ πῦρ ἐστὶν ὡς, ὁ ἀνὴρ ἀκνότερος, ὁ δὲ ἵππος ἀκνότερος. 6. Ἡ βῆξ ἐστὶν ευχρηστερα ἢ το γῆρας. 7. Οἱ ἀλθιπες εἰσι μελαινιατοι. 8. Ουδεὶς των ἀθηναίων ἀκνότερος του Σωκρατους. 9. Κριτίας ἦν ἀρπαγιστερος ἢ Ἀλεξάνδρος. 10. Ουδὲν ἐστὶ των καλων ἀνθων ευχαριστερον.

LESSONS IN BOOKKEEPING.—XXI.

CASH BOOK.

(1)

Dr.

CASH ACCOUNT.

(i)

Cr.

RECEIPTS.				Bank Col.			Cash Col.			PAYMENTS.				Bank Col.			Cash Col.		
				£	s.	d.	£	s.	d.					£	s.	d.	£	s.	d.
1881.	July	1	To Balance				2550	0	0	1881.	July	1	By Balance	2550	0	0			
		6	" Ship Victoria				175	3	0			6	" Union Bank	175	0	0			
		12	" Union Bank	1146	0	0						12	" Bills Payable, No. 101				1145	10	0
		13	" Bills Receivable, No.				1200	0	0			18	" Union Bank	1200	0	0			
		29	" Union Bank. [551	10	0	0						29	" Petty Cash				10	0	0
		31	" Balance	2769	0	0						31	" Balance				2769	13	0
			£	3925	0	0	3925	3	0				£	3925	0	0	3925	3	0

1881.	Aug.	1	To Balance				2769	13	0	1881.	Aug.	1	By Balance	2769	0	0			
		2	" Union Bank	321	0	0						2	" Fox, Tennant & Co.				320	15	0
		4	" T. Brown and Co.				970	0	10			4	" Union Bank	970	0	0			
		29	" Debentures				115	8	0			29	" Union Bank	116	0	0			
		30	" Union Bank	39	0	0						30	" Charges				38	10	6
		31	" Union Bank	15	0	0						31	" Charges				2	12	6
			" Balance	3480	0	0							" Petty Cash				12	10	0
			£	3855	0	0	3855	1	10				" Balance				3480	13	10
			£	3855	0	0	3855	1	10				£	3855	0	0	3855	1	10

1881.	Sept.	1	To Balance				3480	13	10	1881.	Sept.	1	By Balance	3480	0	0			
		"	" P. Hutchinson & Co.				152	10	0			"	" Union Bank	153	0	0			
		2	" Union Bank	13	0	0						2	" Charges				12	17	6
		5	" Union Bank	19	0	0						5	" Charges				18	7	6
		8	" Bills Receivable				730	10	0			8	" Interest				6	1	9
		12	" Union Bank	268	0	0						12	" Union Bank	725	0	0			
		"	" Interest				12	12	3			"	" S. Morley				236	5	0
		15	" Union Bank	1016	0	0						"	" Tuelon and Co.				32	2	0
		"	" Interest				50	16	9			"	" Union Bank	12	0	0			
		17	" Union Bank	905	0	0						15	" W. Phillips				278	15	11
		20	" R. O'Brien & Co.				500	0	0			"	" J. Parker				42	0	0
		21	" Three per Cents				2846	5	0			"	" Matheson and Co.				328	5	4
		23	" Union Bank	24	0	0						"	" T. Barker				367	10	0
		25	" Union Bank	108	0	0						"	" Union Bank	50	0	0			
		27	" Exchequer Bills				1512	7	6			17	" Bills Payable, No. 129				905	0	0
		29	" Union Bank	240	0	0						20	" Union Bank	500	0	0			
		"	" Interest				12	0	0			21	" Union Bank	2847	0	0			
		30	" Union Bank	15	0	0						23	" Charges				23	15	4
		"	" Balance	6684	0	0						25	" Charges				107	8	7
			£	9292	0	0	9297	15	4			27	" Union Bank	1513	0	0			
			£	9292	0	0	9297	15	4			29	" J. Oswald and Co.				240	0	0
												"	" Union Bank	12	0	0			
												30	" Petty Cash				15	0	0
												"	" Balance				6684	6	5
			£	9292	0	0	9297	15	4				£	9292	0	0	9297	15	4

1881.	Oct.	1	To Balance				6684	6	5	1881.	Oct.	1	By Balance	6684	0	0				
		"	" Union Bank	6	0	0						"	" Charges				5	19	6	
		2	" Union Bank	541	0	0						2	" Tuelon and Co.				33	10	0	
		"	" Interest				26	4	4			"	" W. Phillips				256	15	6	
		4	" Bills Receivable, No. 560				1260	0	0			"	" T. Barker				250	16	6	
		"	" Interest				2	3	9			"	" Union Bank	26	0	0				
		8	" Bills Receivable, No. 611				580	0	0			4	" Union Bank	1175	0	0				
		"	" Union Bank	43	0	0						8	" W. Silver and Co.				87	10	0	
		10	" Bills Receivable, No. 561				1000	0	0			"	" Union Bank	580	0	0				
		11	" Union Bank									10	" Charges				42	15	0	
		"	" Bills Receivable, Nos. 613 and 614				250	0	0			12	" Charges				3	4	6	
		12	" Union Bank	5	0	0						14	" Charges				12	11	1	
		14	" Union Bank	11	0	0						15	" Union Bank	250	0	0				
		15	" Bills Receivable, Nos. 613 and 614																	
			Carried forward	£	606	0	0	9802	14	6				£	9715	0	0	603	2	1

C A S H . B O O K .

CASH ACCOUNT (continued).

(2)

(2)

RECEIPTS.			Bank Col.			Cash Col.			PAYMENTS.			Bank Col.			Cash Col.		
1831.			£	s.	d.	£	s.	d.	1831.			£	s.	d.	£	s.	d.
Oct. 21	Brought forward .		606	0	0	9802	14	6	Oct. 21	Brought forward .		9715	0	0	693	2	1
" 21	To Bills Receivable, Nos. 615 and 616 .					290	7	6	" 22	By Union Bank .		290	0	0			
" 22	" Union Bank .		74	0	0				" 23	" Bills Payable, No. 152 .					73	15	0
" 23	" Bills Receivable .					1840	0	0	" 29	" Charges .					1	7	6
" 29	" Union Bank .		20	0	0				" 31	" Union Bank .		1839	0	0			
" 31	" Balance .		11144	0	0				" 31	" Petty Cash .					20	0	0
			£ 11844	0	0	11933	2	0	" 31	" Balance .		£ 11844	0	0	11933	2	0

1831.			£	s.	d.	£	s.	d.	1831.			£	s.	d.	£	s.	d.	
Nov. 1	To Balance .					11144	17	5	Nov. 1	By Balance .		11144	0	0				
" 4	" Union Bank .		300	0	0				" 4	" Bills Payable, Nos. 141 and 142 .					700	0	0	
" 7	" Bills Receivable, No. 610 .					1000	0	0	" 7	" Ditto, Nos. 147, 148, and 149 .					600	0	0	
" 8	" Ditto, Nos. 625, 626, and 627 .					600	0	0	" 8	" Union Bank .		600	0	0				
" 9	" W. Knight and Co. Bills Receivable, Nos. 564 and 565 .					234	0	0	" 9	" W. Knight and Co. Union Bank .		232	0	0		2	6	9
" 10	" Ditto, No. 612 .					1610	5	0	" 10	" Union Bank .		1610	0	0				
" 12	" Union Bank .		1881	0	0	876	15	0	" 12	" Insurance .					1880	15	0	
" 14	" Three per Cents .					2876	5	0	" 14	" Union Bank .		2877	0	0				
" 16	" Union Bank .		60	0	0				" 16	" Bills Payable, No. 140 .					60	0	0	
" 17	" Exchequer Bills .					2500	0	0	" 17	" Union Bank .		2500	0	0				
" 18	" Union Bank .		133	0	0				" 18	" Bills Payable, No. 153 .					132	10	0	
" 19	" Union Bank .		400	0	0				" 19	" Ditto, Nos. 144 and 145 .					400	0	0	
" 22	" W. Knight and Co. Bills Receivable, Nos. 619, 620, and 621 .					676	5	6	" 22	" W. Knight and Co. Union Bank .					6	16	7	
" 23	" Ditto, No. 631 .					600	0	0	" 23	" Union Bank .		669	0	0				
" 30	" Union Bank .		10	0	0	135	0	0	" 24	" Union Bank .		690	0	0				
" 31	" Balance .		18460	0	0				" 30	" Petty Cash .		135	0	0		10	0	0
			£ 21244	0	0	22253	7	11	" 31	" Balance .		£ 21244	0	0	22253	7	11	

1831.			£	s.	d.	£	s.	d.	1831.			£	s.	d.	£	s.	d.
Dec. 1	To Balance .					18460	19	7	Dec. 1	By Balance .		18460	0	0			
" 2	" Debentures .					215	12	0	" 2	" Union Bank .		216	0	0			
" 3	" Dawson and Hancock .					1750	0	0	" 3	" Union Bank .		1750	0	0			
" 4	" Debentures .					182	0	0	" 4	" Union Bank .		182	0	0			
" 9	" Bills Receivable, Nos. 622, 623, and 624 .					1326	10	0	" 9	" Bills Payable, No. 143 .					600	0	0
" 10	" Ditto, Nos. 628 and 629 .					160	0	0	" 10	" Union Bank .		727	0	0			
" 15	" Ship Victoria .					300	0	0	" 15	" Union Bank .		160	0	0			
" 19	" Exchequer Bills .					500	0	0	" 19	" Union Bank .		300	0	0			
" 21	" Union Bank .		300	0	0				" 21	" Bills Payable, No. 146 .					300	0	0
" 21	" Bills Receivable, No. 630 .					350	0	0	" 24	" Union Bank .		350	0	0			
" 24	" Union Bank .		117	0	0				" 26	" A. Lloyd .					116	11	0
" 26	" Exchequer Bills .					1297	12	6	" 26	" S. Morley .					960	15	0
" 27	" T. Ellis and Sons .					132	10	0	" 27	" Union Bank .		543	0	0			
" 27	" Fox, Tennant, and Co. .					73	15	0	" 27	" T. Brown and Co. .					260	0	0
" 27	" Bills Receivable, No. 632 .					260	0	0	" 28	" P. Hutchinson and Co. .					32	7	6
" 28	" Union Bank .		32	0	0				" 30	" Union Bank .		439	0	0			
" 30	" R. O'Brien and Co. .					438	17	0	" 31	" Petty Cash .					20	0	0
" 31	" Union Bank .		20	0	0				" 31	" Union Bank .		116	0	0			
" 31	" Interest .					116	11	2	" 31	" Balance .					23274	13	9
" 31	" Balance .		23274	0	0							£ 23743	0	0	25564	7	3
			£ 23743	0	0	25564	7	3				£ 23743	0	0	25564	7	3

READINGS IN GERMAN.—V.

5.—Die sieben Kindlein.
Deo zee-ben kind'-line.

Am frühen Morgen, als die Dämmerung aufging, erhob
Am früh-mor'-ghen, als die dem-mai-röck auf-ging, erhob
sich ein frommer Hausvater, mit seinem Weibe von dem nächst-
zy ino röm'-mer hause'-fah-ter mit zi-nem vi-bai fön daim ney'-
lichen Lager, und sie dankten Gott für den neuen Tag und
Ny-ten lah'-ghor, dunt zee dank'-ten got für dain noi-en tahdy dunt
die Stärkung des Schlummers.
dee shterr'-köök dess shldöm-mers.

Das Morgenroth aber strahlte in das Kämmerlein, und
Dass mor'-ghen-rote' ah'-ber shtrahl'-tai in dass kom'-mer-line, dunt
sieben Kindlein lagen in ihren Betten und schliefen.
zee-ben kind'-line lah'-ghen in ee-ren bet'-ten dunt shlee'-fen.

Da sahen sie die Kindlein an nach der Reihe, und die Mutter
Dah zah'-hen zee deo kind'-line an nach dair ri-hai, dunt dee müt'-ter
sprach: Es sind ihrer sieben an der Zahl! Ach, es wird
shprach: Es sind ihrer sieben an der Zahl! Ach, es wird
unbarm sein, sie zu ernähren, also schufte die Mutter,
dass barmt fal'-len, zee tsoo ern-ney'-ren, al'-zo zolfts-tai dee müt'-ter,
denn es war eine Theurung im Lande.
denn ess war i-nai toi-röök im lan'-dai.

Der Vater aber lächelte und sprach: Siehe, liegen
Dair fah'-ter ah'-ber ley'-fel-tai dunt shprach: Zee-hai, lee'-ghen
sie nicht und schlummern alle sieben? und haben noch
zee nist dunt shldöm-mern al'-lai zee-ben? dunt hah'-ben ro'-tai
Wangen allumal, und es fließt auch von neuem das Morgen-
vang-en al'-tsoo-mahl, dunt ess floisst auch fön noi-en dass mor'-ghen-
roth über sie her, daß sie noch schöner erscheinen und wie
rote' ah'-ber zee heyr, dass zee noch shd'-ner err-shi'-nen dunt voo
sich sieben Kindlein. Mutter, dies jungst und ja,
zee-ben blü'-hen-dai rös'-line. Müt'-ter, deess taci'-ghet duns yab,
daß Er, der das Morgenroth machet und den Schlaf sendet,
dass eyr, deyr dass mor'-ghen-rote' mach'-ghet dunt dain shlahf zeu'-det,
getreu ist und ohne Wandel.
gai-troi' ist dunt o'-nai van'-del.

Und als sie nun aus dem Kämmerlein traten, da standen
dunt als zee noon ousa daim kem'-mor-lire trah'-ten, dah shtan-den
an der Thür vierzehn Schuhe in einer Reihe, immer kleiner und
an dair tü'r fir'-tseyu shoo'-hai in i'-ner ri-hai, im-mor klü'-ner dunt
kleiner, je zwei für ein jegliches Kindlein. Da sah die
klü'-ner, yey tswi für ine yey'-ly'-yess kind'-line. Dah zah deo
Mutter sie an, daß ihrer so viele waren, und sie weinete.
müt'-ter zee an, daß ihrer so vie-le waren, dunt zee vi'-wai-tai.

Der Vater aber antwortete und sprach: Mutter, was
Dair fah'-ter ah'-ber ant'-vör-tai-tai dunt shprach: Müt'-ter, vass
weinst du? Haben sie doch alle sieben die runden und
vi-nest doo? Hah'-ben zee doch al-lai zee-ben deo rön'-den dunt
munteln Köpfe empfangen, wie sollten wir denn um die
mön'-tern küss'-line em-pfang-en, voo zöl'-ten veer den döm deo
Hüllen uns ansetzen! Haben doch die Kindlein Vertrauen
höl'-len duns eng'-sten! Hah'-ben doch die kind'-line ferr-trow'-en
zu uns, wie sollten wir es denn nicht zu dem haben, der
tsoo duns, voo zöl'-ten veer ess den nist tsoo deym hah'-ben, deyr
mehr vermag, als wir verstehen. Siehe, seine Sonne
meyr ferr-mach', als veer ferr-shtern'. Zee-hai, zi-nai zön'-nai
kommt! Wohlan, laß uns auch unsern Tagelauf wie sie mit
kömt! Vole-an, lass duns auch dän'-zern tah'-gai-louf voo zee mit
fröhlichem Muth beginnen.
frö'-ly'-yem ant'-liss bai-ghin'-nen.

Also zutreten sie und wirkten, und Gott segnete ihre
Al'-zo rey'-dai-ten zee dunt virk'-ten, dunt got zeyg'-nai-tai ee'-rai
Arbeit, daß sie genug hatten sammt den Kindern, denn der
arr'-bitte, dass zee gai'-mödy hat'-ten zamt dain kin'-dern, denn dair
Glaube erhebet den Muth und die Liebe gewähret
glou'-bai orr-hey'-bet dain moo't dunt dee lee'-bai gai-vey'-ret
Stärke.
shterr'-kai.

VOCABULARY.

Sieben, seven.	Theurung, f. famine,	Sülle, f. covering,
Dämmerung, f. dawn.	dearth. (thier,	shell.
(dämmern, to	dear.)	Sich ängsten, to fret
dawn.)	Allumal, all toge-	(Angst, f. anxiety,
Aufgehen, to rise.	ther.	terror.)
Hausvater, m. father	Fließen, to flow.	Vertrauen, n. confi-
of a family.	Erstehen, to appear.	dence.
Nächtlich, nightly.	Blühen, to bloom.	Dem . . . der, to
(Nacht, f. night.)	Zeugen, to prove, wit-	him, to the one
Lager, n. couch,	ness, testify.	who.
camp.	Der, vi, das, relative	Mehr, more.
Danken, to thank.	pronoun, who,	Bemühen, to be able
Gott, m. God.	which.	to do.
Stärken, to streng-	Machen, to make.	Verstehen, to under-
then. (Stärkung, f.	Glauben, faithful.	stand.
strongthoing.	Dane, without.	Comme, f. sun.
Stärke, f. strength.)	Wandel, m. change,	Wohlan, well, then.
Schlummer, m. slum-	doing, acting.	Lassen, to let, leave.
ber.	Stehen, to stand.	Kauf, m. course.
Strahlen, to beam.	Thür, f. door.	Sie, f. she, her.
Bett, n. bed.	ierzehn, fourteen.	Muth, n. counte-
Schlafen, to sleep.	De zwei, two and	nance.
Reihe, f. turn, line.	two.	Wirken, to be active,
(nach der Reihe, one	Ein jegliches, each.	to act.
after the other.)	Viel, much, many.	Segnen, to bless.
Ihrer, genitive, of	Rund, round.	Mühe, f. work, labour.
them.	Munter, cheerful.	Glaube, m. faith, belief.
Zahl, f. number.	merry, lively.	Muth, m. courage.
Hart, hard, diffi-	Ruß, m. foot.	Gewähren, to grant,
cult.	Empfangen, to receive.	bestow.

KEY TO EXERCISES IN LESSONS IN GERMAN.

EXERCISE 107 (Vol. II., page 156).

1. Nichts geschieht ohne Gottes Erlaubnis. 2. Die Macht Gottes
ist durch die ganze Welt bekannt. 3. Die französische Revolution des
letzten Jahrhunderts erschütterte ganz Europa. 4. Der einigen Tagen
ging ich den Rhein entlang, von Coblenz nach Barmen, spazieren. 5. Du
wirst mich ohne Zweifel um meine Meinung fragen. 6. Diese Dame ist
nach der französischen Mode gekleidet. 7. Ich habe durch seine Verluste
nichts gewonnen. 8. Sie gingen alle, außer zweien, auf das Land. 9.
Das Schiff, in welchem wir uns befanden, hatte Wind und Ebbe gegen sich.
10. Ich habe alle Dörfer um Paris gesehen. 11. Er unternahm die Arbeit
für mich. 12. Er ging die Küste entlang.

EXERCISE 108 (Vol. II., page 156).

1. The boy sat by the spring. 2. Many circumstances are connected
with this event. 3. On the mountains the air is purer than in the val-
leys. 4. One should not depend too much on men. 5. The enemy
entrenched himself behind those walls. 6. A friend placed himself
behind me. 7. In this house are many rooms. 8. Every man should
examine his own heart. 9. Near the house stands the barn. 10. His
niece seated herself at my side. 11. Above us we perceive the heavens.
12. I cannot judge concerning this man's excellences. 13. Of all
friends this is the dearest to me. 14. Jesus turned unto his disciples,
and said, "He that hath ears to hear, let him hear." 15. I have no
secrets with my friends. 16. The coachman puts the horses to the
wagon. 17. The moon often comes between the sun and the earth,
and the earth between the sun and the moon. 18. The unfortunate
man's arm came between the machine's crushing wheels. 19. From
one subject they came to the other. 20. They put the oxen to the
plough.

EXERCISE 109 (Vol. II., page 156).

1. Er kletterte auf einen Baum. 2. Tugend wehrt in dir. 3. Ich
sah ihn in der Kirche. 4. Die Stadt lag hinter mir. 5. Mein Freund
war neben mir. 6. Meine Schwester spielte auf dem Pianoforte. 7. Sein
Kette dauerte über zwei Stunden. 8. Ein Rathgeber steht über einem Pro-
ceten. 9. Er verbirgt sich hinter dem Baume. 10. Er hat es im Äger
gethan. 11. Rast uns in das Haus gehen. 12. Er wünschte, in die
Familie des Herrn N. eingeführt zu werden. 13. Er geriet in kurzer Zeit
sehr in Schanden. 14. Sie gingen über das Eis. 15. Sie haben das
Wasser über den Felsen verschüttet.

EXERCISE 110 (Vol. II., page 180).

1. This man's coat does not fit him. 2. My brother, the physician,
and I go day by day to the river. 3. Both these sisters sew and knit
day by day. 4. This picture belonged to my deceased friend. 5. This
colour belongs to the painter. 6. This town has great similarity to a
fortress. 7. Do you find no similarity to my father in this portrait?
8. No, it more resembles your nephew. 9. How comes it, my friend,

that thou art so sorrowful to-day? 10. This cloak becomes me better
than mine. 11. A cloak need not become well, if it only keeps one warm.
12. How does this coat become me? 13. The waistcoat becomes you better
than the coat. 14. These gloves, I imagine, do not fit you. 15. These
will fit me better, because they are somewhat larger. 16. This dress
fits the boy very well. 17. Does this or that cap become me better?
18. It seems your slippers do not fit you well. 19. They only buy
clothes which become them well. 20. To whom does this house be-
long? 21. It belongs either to her or to him. 22. To whom do those
gloves belong? 23. They belong to this lady. 24. To which girl does
this veil belong? 25. To which ship do these sailors belong? 26.
Whose mules are these? 27. They belong to me. 28. Whose hat is
this on the table? 29. It is either mine or his.

EXERCISE 111 (Vol. II., page 180).

1. Wessen Rock ist dieser an der Wand? 2. Es ist entweder der meinige
oder der deinige. 3. Jene Herrin gehen jeden Tag baden. 4. Können Sie
mir sagen, wem diese Pistolen gehören? 5. So viel ich weiß, gehören sie
dem Doctor. 6. An wem ist heute Nacht die Reife zu machen? 7. Die
Reife ist an mir. 8. Die Reife kommt jetzt an mich. 9. Der St. Marius
Platz in Venedig ist so rein und gerlich, daß er einem großen Saale gleicht.
10. Die Gasse hat an Gestalt und Größe Ähnlichkeit mit der Gasse.
11. Das Leben des Menschen gleicht einem Schiffe, welches auf bewegter
See geht. 12. Wem gehören alle diese schönen Bilder? 13. Sie gehören
meinem Freunde, dem Maler. 14. Die Ähnlichkeit zwischen ihm und seiner
Schwester ist sehr auffallend. 15. Der Arzt hat den Mediciner ihn nach
dem Saale zu begleiten. 16. Der Schneider hat eben den neuen Rock um
die Hüfte von Marius geschickt. 17. Die Gestalt war den Widen durch
einen großen Mantel entzogen. 18. Wo sind meine Mergenschuhe? 19.
Die Fahne weht stolz über der Festung. 20. Der Maler wird morgen ein
neues Bild zu malen anfangen.

EXERCISE 112 (Vol. II., page 222).

1. The concert announced in the newspaper will not take place this
evening. 2. Will you grant my petition? 3. I will grant it, if you
are more careful from this time forth. 4. Humility shows itself in
true love of one's neighbours. 5. From this time forth the country
became more and more charming. 6. Henceforth we shall be con-
tented. 7. Hence it was that so many undertakings failed. 8. Hence
he seized the opportunity to remonstrate with him. 9. You are your-
selves in fault at that matter, you cannot therefore complain. 10.
Charles always learns assiduously, for that reason his teachers praise
him. 11. You need not be angry because I have used your pen. 12.
The diligent scholar overcomes the difficulties which every foreign
language involves. 13. Joseph the Second was an enlightened prince
and the father of his people; for that reason, people still always speak
of him with great respect. 14. He went up to the summit of the moun-
tain. 15. Will you not wait till you have an answer? 16. No, I cannot
wait any longer. 17. As he would not stay till I had written my letter,
I could not but suppose that he would not do me that favour. 18.
Alexander conquered many nations at the beginning of his reign, and
thus commenced his career with warlike actions. 19. According to
this intelligence he may therefore hope to see once more his father.
20. I shall punctually attend to everything for you, therefore he
under no unreason. 21. He was not at home, consequently I could
not deliver the letter to him myself. 22. After the colonel had hoisted
his standard, the soldiers formed around it. 23. Is Mr. N. well? 24.
Yes, he is remarkably well.

EXERCISE 113 (Vol. II., page 222).

1. Gibt es auch ein Denkmal des Güttenberg, des Erfinders der Buch-
druckkunst? 2. Ja, es gibt deren zwei; das eine befindet sich in Mainz,
das andere in Straßburg. 3. Gibt es unartige Kinder in Ihrer Schule?
4. O, ja, es gibt deren viele. 5. Diese Reife gehören um jene Fässer. 6.
Die Vertierung des Herzogs von Wellington fand am achtzehnten November
1852 Statt. 7. In der Versammlung, welche gestern Statt fand, sprachen
einige Redner mit großer Begeisterung. 8. Von jener Zeit an strebte er
nach größerem Ruhme. 9. Er ergriff die erste Gelegenheit, seinen Bruder
von der Wahrheit seiner Aussagen zu überzeugen. 10. Bis heute hatte ich
keine Antwort von ihm erhalten. 11. Der Regen hat uns bis auf die Haut
durchnäßt, deshalb werden wir unsere Reife bis heute Abend verschicken.
12. In früheren Zeiten fanden mehr Munter und Reichen Statt, als in der
jetzigen Zeit.

EXERCISE 114 (Vol. II., page 246).

1. A spiritual enjoyment is more durable than a sensual one. 2.
The voracious man never obtains so much as he wishes to have. 3.
The higher one gets in the upper regions, the colder it becomes. 4.
The more one party hated him, the more the other loved him. 5. The
higher Napoleon rose, the more ambitious he became. 6. The adjacent
river affords the neighbouring inhabitants many advantages. 7. How
much of your property have you lost? 8. I have lost more than half.
9. What day of the month do you set out from here? 10. My depa-
ture is fixed for the twelfth of this month. 11. What day of the
month will your brother come here? 12. I expected him three days

ago. 13. A year ago I was still in Germany. 14. A few years ago the
most learned and able men had their residences in Weimar. 15. Iron
is more useful than gold and silver, although the value of gold and
silver is greater. 16. The whole multitude was of one opinion. 17.
They spoke of nothing but the future. 18. I wrote my friend only a
few words. 19. Around the whole town were none but cruel enemies
encamped. 20. Force alone could be effective here. 21. Although
he has nothing but pain and toil, yet he is always of a cheerful dis-
position.

LESSONS IN GEOLOGY.—IV.

SPRINGS, RIVERS, ETC.

Intermittent Springs.—Perhaps one of the most curious phe-
nomena exhibited by springs is that where the waters of a
spring disappear, and after a lapse of time the flow recom-
mences, continuing with unabating force until it suddenly
ceases—in due time appearing again. This can only be ac-
counted for upon the supposition that the water collects in
some subterranean cavern, the outlet to which springs from
near the bottom, and traverses the rock in the form of a siphon;
when the water has risen in the reservoir to the level of the
bend of the siphon-channel, the spring begins to run, and con-
tinues its flow until the cavern is emptied.

The spring will then remain dry until such time as the level
of the water reaches the same height again. This phenomenon
is explained in Fig. 9.

There is a spring of this description near Caterham; peri-
odically it discharges a large volume of water, which flows for
two or three months; the South-Eastern Railway crosses its
course at Caterham Junction. The writer of these pages was
told that the spring began its flow when the water in the quar-
ries at Godstone had risen to a certain height. If this be the
case, in the chalk hills of the neighbourhood there must be an
enormous cavern, which has at least two outlets. The one at
Caterham is the extremity of a siphon-like fissure; while in
excavating the Godstone quarry, another fissure, which com-
municated with the cavern, was opened.

Mineral Springs are those whose waters are charged to an
unusual extent with various soluble salts. When lime is present
in water, it is rendered soluble by the presence of carbonic
acid gas. On exposure to the air, or when heated, the gas is
driven off, and the water, being unable longer to keep in so-
lution the lime, deposits it—thus forming a limestone rock.
One of these springs near Clermont, in Auvergne, has formed an
incrustation of white concretionary limestone, 240 feet in
length, and sixteen feet thick. The action of such springs in
transporting the matter of the rock through which they pass
is well illustrated by sections of water-pipes—frequently seen
in geological museums—in which the encrusting of the limestone
has all but completely filled up the pipe.

There is a noted mineral spring at San Filippo, in Tuscany,
from which a deposit of a foot in thickness can be obtained in
a month; hence we are not surprised to find that the spring
has formed on the side of the mountain a deposit a mile and a
quarter in length, a third of a mile in breadth, and often 250
feet thick.

Limestone thus deposited from mineral springs bears the
technical name of *Travertin*. Should the waters of a spring
charged with sulphuric acid pass through a limestone rock,
they will become charged with gypsum or sulphate of lime,
which is deposited along the course which the waters take.
Many springs of this nature are known; for example, those of
Baden, near Vienna, the thermal waters of Aix, in Savoy, and
many of the Iceland springs. The hot springs of the island of
St. Michael, in the Azores, and also some of the Iceland springs,
deposit silica—the matter of which flint is composed. Such an
incrustation is termed *siliceous sinter*.

The importance of mineral springs is not to be measured
merely by the deposits they make; but in their passage through
rocks they loosen the fabric of the rock by washing out one or
more of its constituents. Such chemical action we shall notice
under "Fossilisation."

Rivers.—Rivers, although they are not the first causes of the
valleys through which they run, yet in all cases they deepen
the valleys. It is evident that to induce a flow of water, there
must be, to begin with, a fall and a hollow which may act as a
channel. This preparation for the existence of the river may

have been due to volcanic upheaval of the horizontal strata, or to the eroding action of the sea ere the continent was raised out of the water. This latter action may be seen at work upon any mud-flat, when the tide has receded. The surface of the flat is intersected by innumerable channels which drain off the water. These channels are not obliterated by the next tide, but rather deepened, and in time become decided undulations.

When the mud-flat is permanently raised beyond the reach of the tidal waters, then these irregularities of the surface become water-courses, which erode their respective valleys.

In speaking of the eroding and transporting power of water, we must bear in mind that all earths and stones lose one-third of their weight when immersed in water. The mechanical force of water depends upon its velocity, and it increases as the sixth power of that velocity—that is to say, if the velocity be doubled, the motive power becomes sixty-four times greater; if trebled, the transporting force is increased by 729 times. This will readily account for the masses of rock which are known to have been transported by floods. Frequently bridges are borne down by a swollen river, and the blocks of which breakwaters were composed removed many yards by the force of a storm; but the great work carried on by rivers is not by the spasmodic efforts of a flood, but by the continued load of mud which they carry down to the sea.

This being well nigh the most important of geological agents, we shall first consider its simplest case—when a river enters a lake in the basin of which it deposits the mineral matter it holds in suspension.

An admirable instance is offered to us in the Lake of Geneva. At the upper end of the lake the Rhone enters discoloured by mud; but, when it leaves the lake, its waters are a transparent blue—the mud has been deposited in the lake. As this has been going on for centuries, we may expect to find some evidence of the work of the river. This is given us in the alluvial tract which stretches from the head of the lake for some six or seven miles. It is a marshy plain, higher than the level of the water, and occupying what once was the bed of the lake. If this state of things continue, the Rhone will entirely fill up the lake.

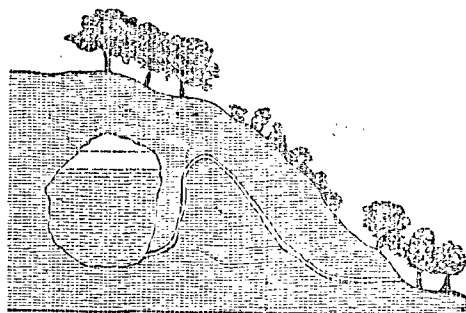


Fig. 9.

The rate of the advance of the delta may be gathered from the fact that the Roman town, Portus Valesia, which stood on the margin of the lake, is now more than a mile and a half inland, the river having added to its delta this quantity in about eight centuries. By soundings it is found that the mud deposit reaches some two miles from the river's mouth.

The great difference between a lacustrine and a marine delta will be found in the fossils preserved; in the one will be the remains of such animals and plants as lived in the river and the country it drained; in the other will be found a preponderance of the fossils of marine life.

Almost every river enters the sea through a delta; that is, its main stream divides into two or more channels, thus making a triangular island, approaching to the shape of the Greek capital Δ (delta). A glance at a map of the world will furnish many instances of this.

Egypt, from the vast antiquity of its history and monuments, offers peculiar opportunities for the measurement of fluvial depositions. The Nile—as Herodotus observed—has probably made Egypt by filling up an arm of the Mediterranean. It must have commenced its work at an age very remote, for the rate of its deposition seems to be three and a half inches a century.

This is gathered from the accumulation of mud around the base of the obelisk at Heliopolis, and the pedestal of the statue of Rameses at Memphis. This colossal image, according to Lepsius, was built 1361 years B.C. Between that time to the year 1850, nine feet four inches of mud has been deposited, which gives a mean increase of three and a half inches a century. A boring was made in the immediate neighbourhood, and at a depth of thirty-two feet a piece of burnt brick was found, upon which discovery it was asserted that man inhabited the Nile valley 13,496 years ago—a conclusion in which no unbiassed mind will acquiesce, seeing it is based upon the fact that

the Nile, whose waters come down loaded with loam, only deposits about $\frac{1}{10}$ th of an inch of mud in a season! We shall allude to this and similar questions in a chapter on "The Antiquity of Man."

The deposition made by rivers has not only an effect in forming deltas, but also tends to elevate their own channels; so that at the present time the inundating waters of the Nile reach further and are reclaiming more of the desert than ever they did.

This is remarkably exhibited in the case of the Po and the Adige. Slowly traversing the flat plain of Lombardy, the Po deposits much of the sediment it carries in its own channel, before its waters reach the sea. The effect of this is to raise the water-course above the surrounding country; frequently its banks have given way, causing terrible destruction, and the river has found for itself a new channel.

To diminish the probability of these inundations, each succeeding spring the bed of the river is dredged, and the mud added to the banks. The consequence is that the rivers run like aqueducts, much above the level of the plain. At Ferrara, the surface of the Po is higher than the roofs of the houses; but at the same time this has the effect of narrowing the river's channel, thus enabling the waters to carry more of the sediment to the sea; so that the delta now gains seventy metres a year; whereas, 200 years ago, it seems only to have been increased by an annual addition of a third of this quantity.

The increase of the delta is rendered evident by the fact that the town of Adria, which gave its name to the gulf, was a seaport in the time of Augustus—now it is twenty Italian miles from the coast. Some indication of the thickness of this alluvial deposit was given by boring an Artesian well at Venice. At a depth of 400 feet the same kind of matter was brought up as that which is now in course of deposition.

The delta of the Mississippi has an area of 12,300 square miles. The river brings down $\frac{1}{10}$ th of its weight of solid matter, or more than 6,000,000,000 cubic feet annually; yet such is the vast size of the delta, that Sir Charles Lyell computes it has been in the course of formation for 33,500 years.

The Ganges performs even a greater work of transportation. In the four rainy months, at 500 miles from its mouth, it was found to bear seawards 577 cubic feet of solid matter a second! Its annual discharge has been computed to be 6,363,077,440 cubic feet—an amount of matter equal in weight to sixty Great Pyramids of Egypt, although the base of that immense pile covers eleven acres, and its apex is 500 feet above the level of the plain. Such a deposit, if accumulated upon Ireland, would raise the surface of the whole island one foot in 144 years.

Yet even this does not measure the deposition which is going on in the upper part of the Bay of Bengal; for the Brahmaputra, in all probability, contributes as much as the Ganges to the sedimentary accumulation. The instances which we have cited are not singular, for every river bears down to the ocean an amount of matter in proportion to the volume of water it discharges, and the nature of the country which it drains.

The construction of a delta depends very much upon the position of the river's mouth. If the point of its embouchure be swept by an ocean current, the sediment has no time to settle, but is carried out to sea, where it gradually subsides along the path of the current, while its lighter particles tint the water for thousands of miles. This is the case with the Amazon, the Rio de la Plata, the rivers of Britain and Western Europe. Every oceanic current has a colour peculiar to itself, imparted to it by the foreign matter which it carries; this it deposits perhaps on the opposite side of the globe to that where it was eroded.

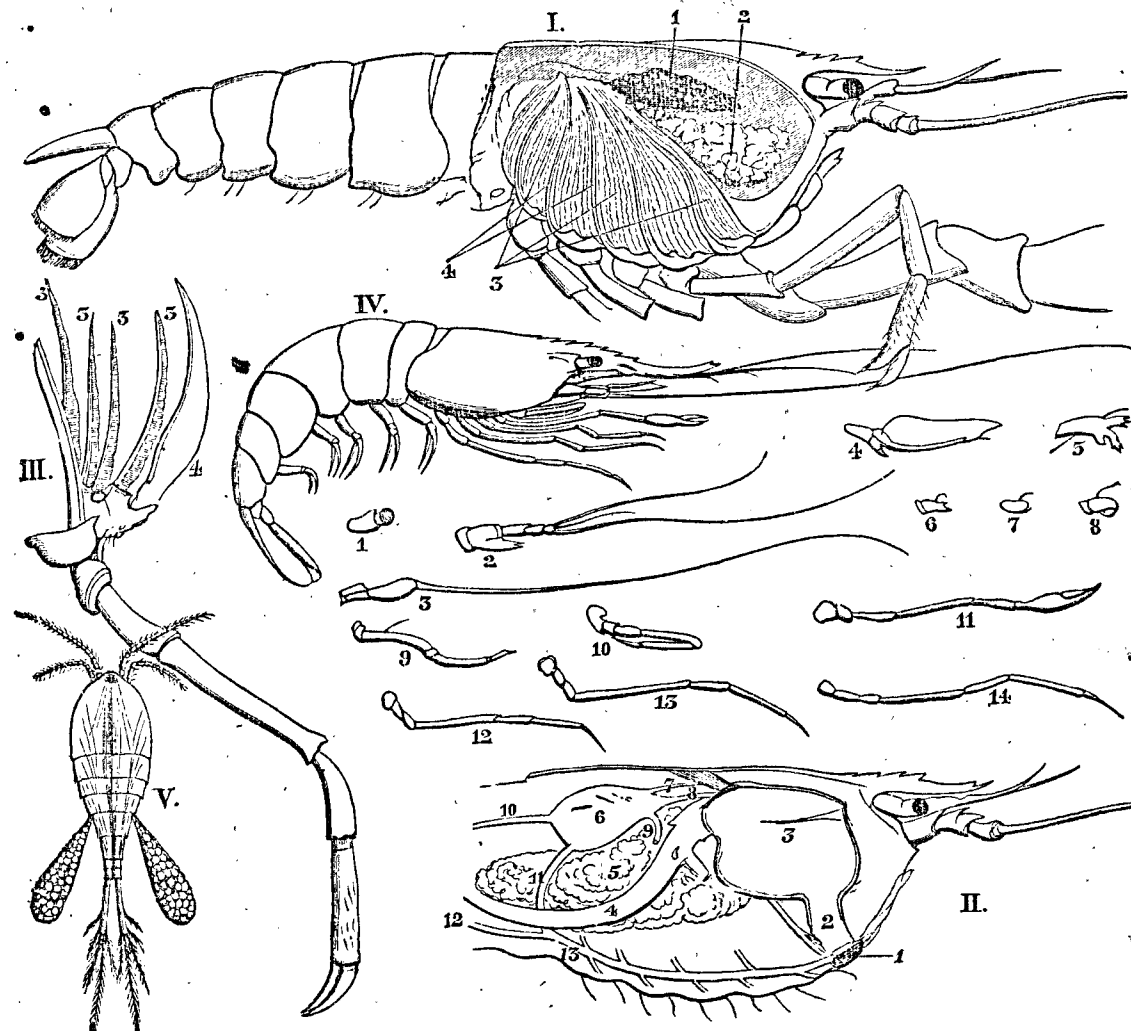
This mighty agent is so universal in its action, so gradual, and yet so continuous, that its work can only thus be seen in its results; but let the observer who watches the course of the rivulet gradually widen—who sees the river undermine its bank, and time after time the overhanging fragments carried away by the stream—remember that the same never-ceasing agent is doing the same work in every streamlet and every river in the world; and he will cease to wonder that it is possible that the masses of sedimentary strata owe their existence to the power of running water.

COMPARATIVE ANATOMY.—XII.

CRUSTACEA.

In the last four lessons we have been tracing upwards the progressive modifications which occur among those animals which have been called *Articulata* on account of their jointed external skeleton, and *Homogangliota* from their repeated and similar nervous masses. It will be observed that after leaving the in-

prepared and educated for its final and fully developed stage. It would be almost as false to call these insects aquatic as to speak of the condition of the higher animals in their state before birth as if it were the final one. In some cases, however, as we have seen, the perfect insect is found in water; but even in these cases the creatures have rather invaded the watery domain than been born to it. Thus the water-beetles rise in the night and fly from pool to pool, and while under water must frequently



- I. LOBSTER WITH ONE SIDE OF THE CARAPACE REMOVED TO SHOW THE GILL-CHAMBER, LEGS AND LIMBS REPRESENTED AS IF CUT SHORT. II. LOBSTER REPRESENTED AS IF CUT THROUGH A LITTLE ON THE NEAR SIDE OF THE MID-LINE, ONLY CEPHALO-THORAX REPRESENTED. III. LEG OF LOBSTER, WITH FLAP AND GILLS. IV. PRAWN (CRANGON) AND ITS SEPARATE PARTS DETACHED. V. CYCLOPS WITH EGG-POUCHES. Ref. to Nos. in Figs.—I. 1, ovary; 2, liver; 3, gills; 4, flabellum. II. 1, jaw; 2, throat; 3, stomach; 4, intestine; 5, liver; 6, heart, with slit to receive venous blood; 7, artery to head; 8, artery to stomach; 9, artery to near lobe of liver; 10, artery to upper part of tail; 11, sternal artery dividing below into—12, sternal abdominal artery; 13, foot and gill artery. III. 3, 3, gills; 4, flap. IV. 1, eye; 2, 3, antennae; 4-9, foot jaws; 10-14, walking limbs.

definitely elongated diffuse and limbless animals known as worms, we have all along been describing creatures whose life is passed in the air. We have, as it were, seen the articulate type proceed from its sprawling procumbent condition, gather itself together, put forth limbs, and endue itself with armour, perfect its organs of sense, enter upon the domain of the air, and finally take wing, and vie with the swiftest bird in precision and power of flight. All these animals from the *Julus* upwards are formed for life in the refined and rare medium of the atmosphere. It is true there are some apparent exceptions to this rule. Thus the larva state of many insects is passed in water. This, however, is an immature state, during which the animal is being

protrude their tails into the air and breathe through the spiracles there situated. The water-scorpion (*nepa*) and boatman (*notonecta*), though they do not often emerge from the streams in which they live, nevertheless continually resort to the surface for air. The former carries a supply of air in the groove which lies between the down-turned edges of its broad, shield-like upper integument and the abdominal surface of its body, while the latter has the faculty of investing itself with a coating of air in some mysterious way, and carrying it down into the depths below. These semi-aquatic creatures breathe air by the same system of trachea as other insects do, and, moreover, their mode of life is exceptional to the class. As a rule, insects

tenant the atmosphere. Many are constantly on the wing, and they are known as the class of animals that give vivacity to the still summer air. It may be further stated that while some larvae of insects inhabit, and some mature forms are found living (though not breathing) in water, all are excluded from the salt water of the ocean. If, therefore, there were no other representatives of the higher forms of articulate than the classes *Myriapoda*, *Insecta*, and *Arachnida*, this great sub-kingdom would be unrepresented in the vast domain of the salt water. The shores, sand, and mud of the sea-bottom might be the home of inert and crawling worms; but its limpid mobile waves would be given up exclusively to fish and sea-snails, star-fish, and sea-jellies. It has pleased the great God, who, we have reason to believe, delights in the variety of forms of animal life, that this shall not be the case. Hence we have in the Crustacea a very large class of articulate whose natural home is the salt water. We must, however, here guard ourselves from misleading by stating that marine existence is characteristic of the Crustacea as a class. Many individuals and whole families of them live ashore. Nevertheless, just as insects are made for the air, so are these creatures created for aquatic life. Their manner of breathing is always after the aquatic type. Lest this last sentence should not be understood, we must recur again to what has been said about the function of breathing—a function which is necessary to almost every animal. This function consists in gaining oxygen or vital air, as it has been well called, for the uses of the system, and in giving up carbonic anhydride, which is the final product of the combination of the oxygen with the constantly changing materials of which the body is composed. Now since oxygen is one-fifth of the air, this gas is readily obtained from the air. We have but to expose a delicate moist membrane to air, and it absorbs the oxygen at once. Since a delicate membrane is best protected by being covered, it is sufficient that an animal have an internal bag to which the air is admitted and sometimes changed. Owing to the readiness with which gases diffuse themselves through one another, carbonic anhydride, or the spent product, readily passes off while the oxygen gains admission. In water, however, it is different. The thing required—namely, oxygen—is just the same; but this is only slightly soluble in water, hence water has always but a very small proportion of this vital element; moreover, the water offers more resistance to the passing off of the spent gas. Hence it follows that much more water must be constantly applied to the breathing organ to get the requisite amount of oxygen, and the carbonic anhydride must be carried away by a current, and not left to diffuse itself. If a water-animal breathed by internal bags, these bags must be emptied completely by the most rapid and violent contractions, and even then provision would have to be made to keep the orifice clear of effete products by passing a current over it. Such an animal would be in the condition of a vessel which has sprung a leak, all of whose crew must work at the pumps for dear life. As a matter of fact, the economy of nature does not admit of such a state of things, and so all water-animals either breathe through the whole skin or parts of the surface are protruded into the water around, and thus the liquids of the body become aerated. Such protrusions of delicate membrane, containing a circulatory fluid, are called gills; and our crustaceans are distinguished from insects by breathing by gills, when they have any breathing organs at all, instead of by a tracheal system. The Crustacea form a class which seem to run parallel with the insects. The highest of them may dispute with these last the palm as to complication of structure, while the lowest stretch downward almost to the Protozoa. If, as we have suggested in a former lesson (Vol. II., page 311), the crustacean type is to be traced up from the Protozoa, not through the Annuloida and the Annelida, but directly through the Rotatoria, it is certainly singular that they should have so many points of similarity to insects; as, for instance, in the nature of their integument, their definite joints, and the character of their limbs, jaws, eyes, antennae, and all the organs of sense. Some may think that insects and crustaceans have arrived at a similar conformation by different routes. These would say, Given that you have an articulate animal well developed for locomotion, it must assume some such form as is common to the insect and lobster. This statement, however, scarcely carries conviction to the mind.

We will now give a description of one of the higher and more typical crustaceans, such as a lobster, crab, or prawn, and

then point out some of the modifications of this type. These creatures are in common speech called shell-fish, but this name is a bad one; for they are not fish, nor can their investment be called a shell, the word shell being more properly applied to the external secretions of the Mollusca. There is, however, one point of similarity in these two kinds of shell—namely, that the earthy salt, carbonate of lime, forms the hard deposit in both cases. This salt, which is the same as chalk, limestone, and Iceland spar, is the one which seems to be the most easily employed by invertebrates to strengthen those tissues which it is necessary should be rendered hard and inflexible for the purposes of the animal. This chalky induration is no doubt taken into the system while dissolved, and circulates with other constituents of the nutritive fluids, and only assumes its hard, stony, and solid form when it has reached the integument of the crustacean, and is there laid up in its cells. When once laid down, however, it seems to be but little liable to be re-dissolved and carried away again, as the organic substances of the tissues are. Probably the lime is absorbed while in some form more soluble than the carbonate, and only becomes the less soluble carbonate by becoming combined with the carbonic anhydride (CO_2), which, as we have seen, is a continual waste product of the system. The reason for this supposition is derived from the fact that when the animal is growing within its stiff hard shell, instead of the earthy particles being partially dissolved and re-arranged with the deposit of more of such particles in the interstices, the whole shell is cast off with the layer of skin which encloses it, and the whole has to be reproduced from below. The whole integument or outer coating of the crustacean is the same as that of the insect. There is the constantly vital inner layer permeated by the blood. Over this is a layer of pigment which gives the colouring to the animal, and which often exudes colouring matter which penetrates the whole of the shell which lies above it; and lastly, there is the external epidermal layer in which the shell is deposited. This last, with its involved chalk substance, is often of great thickness, and the chalk is laid down in closely applied rods or columns, which lie perpendicular to the exterior of the animal. This epidermis corresponds to our scarf-skin. In its physical character it partakes of the nature of this and of horn. Chemically it is different from either of these, as it burns quietly to a white ash, without either melting or swelling up as horn does. Moreover, caustic potash (KHO) will not melt it, nor will nitric acid (HNO_3) colour it yellow, as our epidermis is dissolved and coloured yellow by these several substances. This outer epidermis of the higher Crustacea, which is so thick and hard in some parts, also passes as a thin film over other parts, clothing the whole body and even extending inwards into the alimentary canal. So that when the creature casts off its old coat to allow it to grow, the old slough presents the perfect shape of the living animal, and the coat of the stomach with its internal teeth are also found in connection with the rest. Thus truth is stranger than the wildest fiction. Baron Munchausen, when he could deal in no other way with an enraged wolf, thrust his hand down his throat, and turned him inside out like an old glove; but even Baron Munchausen would have been taken aback if after having done so he found the wolf none the worse. This exuviation, as it is called, is effected in the larger Crustacea by means of a transverse split which occurs between the great dorsal shield and the succeeding parts of the body. Through this the creature escapes, withdrawing all its limbs from their cases, and when they are so large and thick at their terminal joints (as the pincers of the crab are) as to prevent their extrication through the proximal joint-casings, these last split up, and so complete denudation is effected. The fresh skin formed below is at first quite soft and flexible, and the fierce truculent crab, with its formidable toothed and strong pincers, becomes for the time a poor defenceless coward, compelled to skulk about among the stones and chinks of the rocks to avoid enemies which a few days before and a few days after it would defy. If the reader will refer to the second lesson of this series, he will find a detailed description of the divisions of the lobster's body and the limbs which are attached to them. It is needless to repeat this description. There are a vast number of species of Crustacea, and the variations in the number of segments, and the number, position, and shape of the limbs, is almost endless. Another species, the common prawn, with the disarticulated appendages of the first fourteen segments of the body, or those which are included under the great shield

of the back, and called in the aggregate cephalo-thorax, is given in the illustration. In comparing the segmentation of Crustacea with insects, it is thought that the cephalo-thorax, with its stalked eyes, two pairs of antennae, foot-jaws, and walking legs, corresponds not only to the head and thorax, but also with the fore-part of the abdomen of insects. In accordance with this supposition, the part which succeeds to this, and which in the prawn is a large muscular tail, is called the post-abdomen. As has been before remarked, the post-abdomen has limbs, which is not the case with insects or spiders. The position of the principal internal organs would bear out the conclusion that the part corresponding to the front part of the abdomen of insects lies under this great shield. Under it lie the whole of the stomach, generative organs, large liver, and heart, the main portions of which all lie in the limbless after-part of the insect. The mouth opens under the animal, and it is so covered with the great number of pairs of jaws, with their flaps and fringes which guard it, that it is difficult to disclose it. The throat leads upwards into a capacious oval or cubical stomach, whose walls are stiff and strong. It is lined internally with a pile of stiff hairs directed backward, and has at its hind part, from which the intestine proceeds straight to the tail, three strong teeth which masticate the food. This tooth apparatus is worked by muscles which run from the outer wall of the stomach to the shelly sides of the body. These muscles are under the control of the animal, and are worked at will. Such an arrangement is very rare, as in most cases the working of the stomach is quite out of the control of the creature to which it belongs.

The circulatory system is more definite, compact, and perfect than that found in insects. The heart, instead of being long and divided into chambers, is an oval bag which sends vessels forward to the eye, head, antennae, and stomach, sideways to the two large lobes of the liver, and downwards through a great trunk which divides into two; one running to the gills and legs, and the other backward to the tail. The blood from the gills finds its way into spaces lying immediately under the shell, which all communicate with one another, and the largest communicates with the heart by slits in the side of that organ. This higher and better developed blood system is rendered necessary by the breathing organs being confined to certain definite parts—the gills. In those Crustacea where there are no gills, the circulatory system is not so perfect. The gills are organs which sprout from above the basal joints of the walking legs. In the lobster there are several to each leg. They consist of a tapering triangular stem upon which a vast number of little tubular projections are set. These are of thin membrane, and are supplied internally with blood from an artery which mounts the stem, diminishing as it ascends, while the aerated blood is discharged into a vein, which also lies in the stem and enlarges as it descends. Although these organs are essentially gills or outward extensions of the integument, yet they are too delicate to be exposed to the casualties of the outer world. They are therefore included under the dorsal shield. In the lower orders, however, they are exposed and attached to the members of other segments of the body. The gills are thus included in a chamber under the shield. It is of course essential that a free stream of water should pass over them, and to effect this there are two orifices which form the entrance and exit of the water. The entrance lies forward on the side of the mouth, and it has covering it a large flap from the second pair of maxillae or foot-jaws, which is continually worked so as to drive the water inwards. The exit is a long slit behind and below the chamber. Aeration is maintained not only thus but by mechanical means within the chamber; for at the top of each leg there is, besides the gills, a long, stiff, leaf-like projection, which passes up between the gills, and as the animal walks this stiff flabellum squeezes the gills, and so renews both the water without and the blood within them. The position of these gills and flabellum will be seen in the illustration.

The nervous system is like that of the whole of the homöogangliata, but the degree in which the chain of double nerve-knots is dissevered and gathered together varies vastly. Sixty pairs of ganglia are found in one species, and in the crab all except the brain, which is situated above the mouth, and supplies nerves to the organs of sense, are gathered into one nervous ring. The eyes of these higher Crustacea are on the same plan as those of insects. They are, however, set upon jointed movable stems. A discussion of the claims which certain organs in the

antennae of the lobster have to be considered the nose and ear, will be found in the lessons concerning those organs of sense. The enormously long antennae of some of these creatures which are well supplied with nerves must be efficient organs of sense in the dense dark waters of the ocean.

The preceding remarks only apply to those higher families of the Crustacea included under the class Decapoda. We will now very briefly notice the remaining orders, which contain animals of very different structure.

Amphipoda.—The eyes of these are not stalked, but their surface is on the same level as the rest of the body. The first joint of the thorax is made fast to the head, but the two following as well as all the abdominal segments are free. Only the first pair of limbs are transformed into foot-jaws. The gills are in the form of membranous plates, set on the middle thoracic segments. These are never covered in by the shell, but are freely exposed.

The example of this order, which the reader will most likely have fallen in with, is the sand-hopper, which is found in countless multitudes at the edge of the sea. The liveliness of these animals is remarkable, as they are constantly turning somersaults backwards, and in so doing, jerk themselves violently into the air.

Isopoda.—These are segmented like the foregoing, and their gills are like them, but they are set, not on the middle, but the tail segments of the body. The woodlice (*Oniscides*), which, when touched, roll themselves into a perfect ball, are good examples of this order.

Pacilopoda.—These have their backs covered with two shields, one behind the other, which extend on each side far beyond the body which lies beneath them. They have also a hard, sharp tail-piece, which is made use of by the savages of the Moluccas to form the spear.

Branchiopoda.—These Crustacea have one to three pairs of jaws. Their thorax is undeveloped, and with a variable number of abdominal segments to which gill-feet are attached. Frequently the body of these is covered by a shell. The cypris, which is found in almost every pool of water, belongs to this order. The shells of these are often beautifully marked, and as they are found preserved in geological strata, they have been very useful in determining the nature of those strata. Thus, wherever a cypris is found, it is considered certain that the earth was deposited from fresh water; and the nature of their markings is so distinct, that the different species are easily distinguished by the shell alone.

Entomostraca.—These have a well-developed cephalo-thorax. Their abdominal feet are split into two portions, and they are without distinct organs of respiration. To this order belongs the cyclops—thus named on account of its centrally situated single eye. Many also of those shapeless parasites which cling to the gills, eyes, and mouths of fishes, are classed with the Entomostraca.

Cirripedia.—In these, the two sexes are combined in one individual. They are fixed animals, and have a mantle which is furnished with plates of carbonate of lime, like the bivalve shells of molluscs. These are the barnacles. They were long thought to be molluscs, but have all the essential features of true Crustacea.

We have found it convenient to descend in the scale while describing these orders; but it must not be forgotten that the order should be reversed in a tabular classification. Thus:—

1. *Cirripedia* (cirrus, a tendril; pedes, feet), animals with tendril-like feet.
2. *Entomostraca* (εντομα, insect; οστρακον, shell), shelled insects.
3. *Branchiopoda* (branchiæ, gills; πους, foot), gill-footed animals.
4. *Pacilopoda* (πακιδος, varied; πους, foot), animals with variously-shaped feet.
5. *Isopoda* (ισος, like; πους, foot), with like (thoracic) feet.
6. *Amphipoda* (αμφι, both; πους, foot), animals with both kinds of feet on the thorax, i.e., with walking feet and gill feet.
7. *Decapoda* (δεκα, ten; πους, foot), animals with ten walking legs.

Another order called Trilobites inhabited our globe at that very remote period when the primary strata were deposited; not one of them have survived that period. Their remains are, however, found in great multitudes, and the number of species

was large. From these remains we learn that they had a head and tail shield with free segments in between. Their eyes were compound. They could roll themselves into a ball like woodlice. It would seem that they serve to connect many existing orders, having some affinity for the Oniscides and also for the Pœclopoda and Entomostraca.

LESSONS IN FRENCH.—XLIV.

SECTION XCIV.—THE PRESENT PARTICIPLE.—THE VERBAL ADJECTIVE.

1. The present participle is invariable, and ends always in *ant*. It expresses action, not situation. It cannot be rendered into English by an adjective, but should be expressed by the participle present or any other tense preceded by a relative pronoun. The present participle may have an object [§ 66 (1)].

Ces hommes, prévoyant le danger, *Those men, foreseeing the danger, s'enfuyaient.* fled.

2. The part of the verb used after the preposition *en*, is always the present participle:—

En écrivant, en lisant. *In writing, in reading.*

3. When the word ending in *ant* is used to express the qualities, properties, or moral or physical situation of a noun, it is a verbal adjective, and assumes in its termination the gender and number of the noun which it qualifies. It must in this case be rendered into English by an adjective [§ 66 (2)]:—

Ces hommes sont prévoyants. *Those men are cautious, provident.*

4. The verbs *entendre, to hear; faire, to cause, to make; laisser, to let, &c.*, followed by another verb completing their meaning, are not in French separated from that verb. In the corresponding sentences in English, the two verbs are usually separated by other words:—

J'ai laissé tomber mon couteau. *I have let my knife fall (dropped).*
J'ai entendu dire cela. *I have heard that said.*

MISCELLANEOUS EXAMPLES.

Je connais des personnes dormant d'un sommeil si profond, que le bruit de la foudre ne les réveillait pas. *I know persons, sleeping (who sleep) so profoundly, that the noise of thunder would not awake them.* *BESCHER.*
Les eaux dormantes sont meilleures pour les chevaux que les eaux vives. *Sleeping (still) waters are better for horses than running waters.* *BUFFON.*
Nous avons trouvé cette femme mourante. *We found that woman dying.*
Cette femme mourant dans la crainte de Dieu, ne craignait point la mort. *That woman, dying in the fear of God, did not fear death.*
On est heureux en se contentant de peu. *One is happy in contenting one's self with little.*
Avez-vous laissé passer ce voleur? *Have you let that thief pass?*
Je l'ai laissé passer. *I let him pass.*
Pourquoi avez-vous fait faire un habit? *Why have you had a coat made?*
Je n'ai pas fait faire d'habit. *I have had no coat made.*
J'ai laissé tomber quelque chose. *I let something fall.*
Lui avez-vous entendu dire cela? *Have you heard him say that?*
Je le lui ai entendu dire. *I heard him say it.*
Je l'ai entendu dire. *I heard it said.*
Je l'ai entendu dire à ma sœur. *I heard my sister say it.*

EXERCISE 189.

Appliqu-er (s'), 1. ref. Essay-er, 1. to try. Prévenant, e, obliging.
to apply one's self. Hât-er (se), 1. ref. to Préven-ir, 2. ir. to anticipate.
Besoin, m. want. hasten.
Changement, m. alteration. Lecture, f. reading. Répét-er, 1. to repeat.
Émouss-er, 1. to blunt. Obligeant, e, obliging. Sui-vant, e, following.
Empêch-er, 1. to prevent. Plai-re, 4. ir. to please. Sui-v-re, 4. ir. to follow.
Pointe, f. point. Pleuv-oir, 3. ir. to rain. Voyant, e, bright, showy.

1. Ma cousine est-elle aussi obligeante que la vôtre? 2. Elle est aussi obligeante, et bien plus charmante que la mienne. 3. Vos enfants sont-ils prévenants? 4. Mes enfants, prévenant tous mes besoins, ne me laissent rien à désirer. 5. Lisez bien attentivement les pages suivantes. 6. Ces demoiselles, suivant l'exemple de leur mère, s'appliquent à la lecture. 7. Les couleurs voyantes ne me plaisent point. 8. Mes sœurs, voyant qu'il allait pleuvoir, se hâtèrent de revenir. 9. Qu'avez-vous laissé

tomber? 10. J'ai laissé tomber ma plume; la pointe en est émoussée. 11. Les avez-vous fait parler? 12. Je les ai fait parler, mais avec difficulté. 13. Avez-vous fait faire des changements dans votre maison? 14. J'y en ai fait faire. 15. Où en avez-vous fait faire? 16. J'en ai fait faire à la salle à manger et au salon. 17. Avez-vous laissé passer cet homme? 18. Je n'ai pas essayé de l'en empêcher. 19. A qui (whom) avez-vous entendu dire cela? 20. Je l'ai entendu dire à mon père. 21. Je le lui ai entendu répéter. 22. Il vous l'a entendu dire. 23. Il vous a vu faire cela. 24. Il vous l'a vu faire. 25. Je l'ai vu passer.

EXERCISE 190.

1. Are still waters good for horses? 2. Buffon says that they are better for horses than running waters. 3. Are your sisters cautious? 4. They are not very cautious. 5. My sisters, foreseeing that it was going to rain, brought their umbrellas. 6. What have you let fall? 7. I have let my knife and book fall. 8. Do very bright colours please your brother? 9. Very bright colours do not please him. 10. Have you read the following pages? 11. Have you seen the dying woman? 12. Your sister, dying in the fear of God, was very happy. 13. Your sister, following your example, applies herself to study. 14. Have you made them read? 15. I have made them read and write. 16. I made my brother write. 17. I have had a book bound (relier). 18. Has your father had alterations made in his house? 19. He has had some made in it. 20. In which room has he had some made? 21. He has had some made in my brother's room. 22. Whom have you heard say that? 23. I heard my sister say it. 24. Have you heard him say that? 25. I have not heard him say it. 26. Have you seen my father pass? 27. I have not seen him pass. 28. I have heard him speak. 29. Make him speak. 30. Let it fall. 31. Do not let it fall. 32. What has your brother dropped? 33. He has dropped nothing. 34. Whom have you heard say that? 35. I heard your brother say it. 36. I have heard you repeat it. 37. We have seen you do that.

SECTION XCVI.—THE PRESENT PARTICIPLE (continued).

1. French present participles are never employed substantively to express an action. English present participles, when so used, are rendered in French—*a*, by nouns; *b*, by infinitives used substantively; *c*, by verbs in a personal mood*:

a. Gaming is a terrible passion. Le jeu est une passion terrible.
b. Skating is a wholesome exercise. Patiner est un exercice salutaire.
c. They came in without my seeing them. Le dormir est nécessaire à la santé.
Ils entrèrent sans que je les visse.

2. When the English present participle has an object, and is subject of *to be*, it is generally expressed in French by an infinitive preceded by *de*, the French sentence being introduced by *être* with *il* or *ce* as impersonal subject†:

Dying that well is meritorious. Il est méritoire de bien faire cela.
Loving his parents is a good son's duty. C'est le devoir d'un bon fils d'aimer ses parents.

3. Used with a verb, a French present participle may refer to the subject or to the object. When the French present participle refers to the subject it may be preceded by the preposition *en*:

He spoke to me while he was writing. Il me parlait tout en écrivant.
Being tired, I will go to bed directly. Etant fatigué, je vais me coucher.

But when the French present participle refers to the object of the verb to which it is joined, the preposition *en* must never be placed before it; in this case a verb in the infinitive or in a personal mood must replace the present participle:

I see her working. Je la vois travailler.
She perceived a child coming towards her. Elle aperçut un enfant qui venait à elle.

4. Many French present participles are used as nouns in reference to persons and things:—

* The second verb is used in a personal mood when it has another subject than the first.

† As to the use of *il* est, and of *c'est*, see Rule 1, Section 82.

‡ The preposition *en* is the only one which governs the present participle; all the others require the present or the past tense of the infinitive.

There are many Protestants in France. *Il y a beaucoup de protestants en France.*
Your son has lost his shuttle-cock. *Votre fils a perdu son volant.*

5. When an English present participle follows the verb *to be*, it is translated into French in the same tense as *to be* is in English, but *to be* is left out:—

Your father is speaking to a gentleman. *Votre père parle à un monsieur.*

• However, *to be* may be expressed in French, but the English participle is replaced by an infinitive preceded by the preposition *à*; this form frequently occurs in French in familiar conversation and letter-writing:—

His sister will be singing at that time. *Sa sœur sera à chanter à cette heure-là.*

MISCELLANEOUS EXAMPLES.

Fishing is a pleasant pastime. *La pêche est un passe-temps agréable.*
Travelling is instructive. *Voyager est instructif.*
I like her speaking. *J'aime son parler.*
The prisoner slipped away without their seeing him. *Le prisonnier s'échappa sans qu'ils le vissent.*
Obeying him is necessary. *Il est nécessaire de lui obéir.*
Complying with the laws is every citizen's duty. *C'est le devoir de tout citoyen d'observer les lois.*
She was laughing while she was speaking to me. *Elle riait tout en me parlant.*
Wishing to see you soon, I shall start to-morrow. *Désirant vous voir bientôt, je partirai demain.*
Do you hear him singing? *L'entendez-vous chanter?*
He described three men coming towards him. *Il aperçut trois hommes qui venaient à lui.*
The edge of a knife. *Le tranchant d'un couteau.*
There were fifty thousand combatants. *Il y avait cinquante mille combattants.*
I should be working if I were not ill. *Je travaillerais si je n'étais pas malade.*
He was writing to you, when he received your note. *Il était à vous écrire, quand il reçut votre billet.*

EXERCISE 191.

Appris (from apprendre), learnt. Escalier, m. stairs. Regardez, look at.
Arroser, watering. Étudier, studying. Savoir nager, being able to swim.
Assemblée, f. meeting. Éveillez, awake. Se sépara, broke up.
Attendait (from attendre), was waiting for. Fenêtre, f. window. Souffraient (ir. from souffrir), were suffering.
Attendez, wait. Lire, reading. Tard, late.
Broder, embroidering. Manger, eating. Tout en, while.
Choux, m. cabbages. Montaient, coming up. Utile, useful.
De, from. Penchant, m. inclination. Ven-ir, 2. ir. coming.
Dort (ir. from dormir), sleeps. tion. Volant, stealing.
Droit, right. Presque, almost. Voyais (from voir), saw.
Écoutez, listening. Primes (ir. from prendre), caught.

1. L'assemblée se sépara tard. 2. Savoir nager est utile. 3. Le manger est nécessaire à tous les animaux. 4. Regardez vos enfants, qui s'amusent dans le jardin. 5. Nous les avons entendus venir. 6. Ayant appris que mon père était ici, je suis parti immédiatement. 7. Il écrivait tout en m'écoutant avec attention. 8. Je les entendais qui montaient l'escalier en chantant. 9. De ma fenêtre je la voyais lire, arroser ses fleurs et broder. 10. Presque tous les habitants de cette ville souffraient de la fièvre. 11. Nous les primes volant nos choux. 12. Son penchant pour le jeu sera sa ruine. 13. Il dort, ne l'éveillez pas. 14. Elle est à étudier, attendez. 15. Il est aisé de le lui écrire. 16. C'est le droit et le devoir d'un père de corriger ses enfants.

EXERCISE 192.

Beating, battre. Heard, entendions. Success, succès, m.
Bell, cloche, f. Hunting, chasse, f. Teaching, enseigner.
Besiegers, assiégeants. I attribute, j'attribue. Telling, dire.
By herself, toute seule. I will have, je veux. To his knowing, à ce qu'il connaît.
Clapper, battant, m. Laughing, rire. Truth, vérité, f.
Climbing, grimpaient. Met, recontra. Upright, honnête.
sur. Minister, ministre, m. Walking, se promener.
Drinking, le boire. Money, argent, m. Weak, faible.
Given, donné. Playing, jouer. While, en.
He must have, il lui Reçoit, reçu, m. Whilst, tandis que.
faut. Reinforcements, renforts, m. Writing, écrire.

1. Hunting is a wholesome and pleasant pastime. 2. Teaching is difficult. 3. Drinking is necessary to man. 4. I attribute his success to his knowing the minister. 5. We heard them laughing. 6. I often read while walking. 7. Having given him his money, I will have a receipt. 8. We sometimes meet her walking by herself. 9. Did you see her going to the station? 10. They caught him climbing a tree, and stealing fruit. 11. The clapper of the bell has fallen. 12. He is weak, he must have stimulants. 13. Your brother is playing in the garden, whilst my cousin is writing her exercises. 14. The besiegers received reinforcements. 15. Telling the truth is an upright man's duty. 16. Beating that poor dog is cruel.

KEY TO THE EXERCISES IN LESSONS IN FRENCH.

EXERCISE 117 (Vol. II., page 42).

1. Will you not come to see us to-morrow? 2. I shall go to see you, if the weather permits. 3. Will you not send for the physician, if your son is sick? 4. I will go for him myself. 5. When I am tired, I will walk more slowly. 6. When you know his dwelling, shall you go to see him? 7. I shall go and see him as soon as I know (shall know) where he lives. 8. Shall you not see him to-day? 9. I shall see him this afternoon. 10. Will you be able to accompany us? 11. I shall do it with much pleasure. 12. Will you not send them strawberries? 13. I will send them some, when mine are ripe. 14. Will it not be necessary to write to them soon? 15. When we have heard from their relation, it will be necessary to write to them. 16. What shall we do to-morrow? 17. We will go hunting. 18. Will you not go to your father's? 19. We will certainly go. 20. When your guitar is arrived, will you lend it? 21. I shall not be able to lend it. 22. At what hour shall you leave to-morrow? 23. I shall leave at five in the morning. 24. Will you not go out this evening? 25. I shall not go out, and I shall go to bed early.

EXERCISE 118 (Vol. II., page 42).

1. Enverrez-vous chercher le médecin? 2. Je l'enverrai chercher cet après-midi. 3. La petite fille n'ira-t-elle pas chercher des pommes? 4. Elle en enverra chercher. 5. Ne vous assiérez-vous pas, quand vous serez fatigué? 6. Nous ne nous assiérons pas, nous n'avons pas le temps. 7. Que fera M. votre frère quand il sera fatigué? 8. Il fera ce qu'il pourra. 9. Cela vaudra-t-il la peine de lui écrire? 10. Cela n'en vaudra pas la peine, car il ne viendra pas. 11. Ne faudra-t-il pas parler au marchand? 12. Il ne faudra pas lui parler. 13. Nous faudra-t-il prendre des passeports? 14. Il le faudra. 15. Votre petit garçon ne marchera-t-il pas plus doucement, quand il sera fatigué? 16. Quand il sera fatigué, il s'assiera. 17. Que fera Mlle votre sœur, demain? 18. Elle ira à l'église et à l'école. 19. Ne viendra-t-elle pas ici? 20. Elle ne pourra venir. 21. Irez-vous à pied ou à cheval? 22. J'irai à cheval. 23. Pourquoi n'allez-vous pas en voiture? 24. Parce que ma voiture est à Londres. 25. Quand les verrez-vous? 26. Je les verrai aussitôt que je pourrai. 27. Viendront-ils chez nous demain? 28. Ils le feront avec beaucoup de plaisir. 29. Quand vous verrez ce monsieur, lui parlerez-vous? 30. Je ne lui parlerai pas. 31. Quand vous aurez écrit vos lettres que ferez-vous? 32. Je viendrai chez vous. 33. Quand vous aurez lu ce livre me l'enverrez-vous? 34. Je vous l'enverrai. 35. L'enverrez-vous aujourd'hui? 36. Je l'enverrai demain. 37. Ils viendront vous trouver demain. 38. Cueillerez-vous ces belles fleurs? 39. Oui, Madame, je les cueillerai demain. 40. Je serai chez votre père ce soir à sept heures et demie. 41. Le tailleur fera votre habit, et vous l'enverra dans une semaine.

EXERCISE 119 (Vol. II., page 74).

1. What coat would you put on if you went hunting? 2. I would put on a green coat. 3. Would you not take off your boots, if they were wet? 4. I would take them off, and I would let them dry. 5. If you were cold would you not draw near the fire? 6. I would certainly draw near it. 7. Would not your little boy go from it if he were too warm? 8. He would go from it very quickly. 9. Would you become weary of being here? 10. I would not become weary of it. I would amuse myself in reading. 11. Would you not make mistakes, if you made that calculation? 12. I should perhaps make mistakes, if I were interrupted. 13. Would you come, if you were invited? 14. I would come with much pleasure. 15. Would you not be better, if you read less? 16. I should be much better. 17. Would it not be necessary to speak to him about your business? 18. It would be necessary to speak to him of it. 19. How much money would you need? 20. I should want a thousand francs, if I made that journey. 21. Would it not be better to speak to him, than to write to him? 22. It would be better to write to him. 23. If you were in my place, what would you do? 24. If I were in your place, I would pay him what I owe him. 25. If I had time, I would willingly carry your letters to the post-office.

EXERCISE 120 (Vol. II., page 74).

1. Ne liriez-vous pas si vous aviez le temps? 2. Je lirais deux heures, tous les jours, si j'avais le temps. 3. Quel habit mettrait M. votre frère, s'il allait à l'église? 4. Il mettrait un habit noir. 5. Mettriez-vous un chapeau noir? 6. Je mettrais un chapeau de paille, s'il faisait chaud. 7. Ne vous approcheriez-vous pas du feu, si vous aviez froid? 8. Nous nous en approcherions. 9. N'ôtiriez-vous pas votre habit? 10. Je l'ôtierais, s'il était mouillé. 11. Iriez-vous chez mon père, s'il vous invitait? 12. J'irais chez lui et chez M. votre frère, s'ils m'invitaient. 13. Mettriez-vous vos bottes, si elles étaient mouillées? 14. Si elles étaient mouillées, je ne les mettrais pas. 15. Combien d'argent vous faudrait-il, si vous alliez en Angleterre? 16. Il nous faudrait trois mille francs. 17. Ne vous porteriez-vous pas mieux, si vous demeuriez à la campagne? 18. Je ne me porterais pas mieux. 19. Ne vaudrait-il pas mieux écrire à votre frère? 20. Il vaudrait mieux lui écrire. 21. Liriez-vous le livre, si je vous le prêtais? 22. Je le lirais certainement. 23. Si vous étiez à sa place, iriez-vous à l'école? 24. Si j'étais à sa place j'irais. 25. Si vous étiez à ma place, lui écririez-vous? 26. Je lui écrirais tous les jours. 27. Mlle votre sœur se tromperait-elle? 28. Elle ne se tromperait pas, elle est très attentive. 29. Si vous vous leviez tous les matins à cinq heures, vous porteriez-vous mieux? 30. Je ne me porterais pas mieux. 31. Aimeriez-vous mieux aller à pied? 32. J'aimerais mieux aller à cheval. 33. Ne vous assiériez-vous pas? 34. Je m'assiérais, si j'étais fatigué.

LESSONS IN ARITHMETIC.—XII.

EXCHANGE.

1. THE value of a fixed sum of the money of one country expressed in that of another, when this value is calculated by a comparison of the weight and fineness of the coins of the two countries, is called the *Par of Exchange*. When for this fixed sum the correct equivalent in money of the other country, calculated on this supposition, can be obtained, the exchange is said to be at par. The exchange, however, between any two countries fluctuates from various causes.

The *Course of Exchange* is the variable sum of the money of one country which happens at a particular time to be equivalent to a fixed sum of the money of another country. Thus, for £1 sterling at one time, 25.15 francs, at another 25.20 francs, may be obtained, according to the course of exchange between England and France.

2. If A owes a correspondent in Berlin, for instance, £500, he might pay his debt by transmitting the value in coin or bullion. But this would be both cumbersome and expensive. If, then, he can find a person, B, who has money owing to him in Berlin, B can draw a bill upon his debtor in Berlin, and sell it to A, who then transmits it to his own correspondent in Berlin. Such bills of exchange are the means by which money transactions between different countries are conducted. The price of such bills will fluctuate according to the demand there may be for them at the time. The excess of their price over the sum they represent can clearly never exceed the amount of the cost of carriage and money value of the risk incurred in forwarding the same sum in specie or bullion.

3. The *Arbitration of Exchange* is the process of fixing the rate or course of exchange between two places, by means of a comparison of the exchange between them and one or more intervening places. Thus a debt in Paris may be paid by means of a bill on Berlin, which is to be again replaced by one on Hamburg, and that, finally, by one from thence upon Paris. The arbitration is said to be *simple* when there is only one intermediate place, *compound* when there are more.

The subject of exchange, however, is too complicated for us to go into more than very superficially.

For information we refer our readers to Kelly's "Universal Cambist."

A large number of questions in exchange can be worked out by the aid of the principles already laid down. Before proceeding to treat of them, we shall explain a method called the *Chain Rule*.

THE CHAIN RULE.

4. If the equivalent of any amount of one quantity is given in terms of another, that in terms of a third, and so on, it is required to find the equivalent of a certain amount of the first quantity in terms of the last.

EXAMPLE 1.—40 lbs. Troy of standard gold are coined into 1869 sovereigns, and standard gold contains 11 parts in 12 fine

gold. Calculate the value of the money which can be coined out of 1 oz. of fine gold.

$\frac{11}{12} \times 12 =$ weight of one sovereign in ounces.
This contains $\frac{11}{12} \times 12$ ounces of fine gold, which (neglecting the value of the alloy) are worth £1.

Therefore, as $\frac{11 \times 40}{1869}$ oz. : £1 :: 1 oz. : value of 1 oz.

$\frac{440}{1869}$ 1869 (£4 4s. 11 $\frac{1}{2}$ d.—Answer.

1760

109

20

2180

1760

420

12

5040

4840

200

5. A convenient way of arranging the operation in questions of this kind is called the *Chain Rule*. It is especially useful in all questions connected with Exchange, and is the method generally used by merchants.

Write down the quantity of which the equivalent is required at the head of a column, as in the working given below. This quantity is generally called the *Term of Demand*.

Draw a sloping line from it to the left, at the extremity of which write down in a second column a quantity of the same kind as the first. Opposite to this place in the first column its equivalent in value of another quantity, and so on.

	1 oz. fine gold
11	12 oz. standard gold
12 oz. —	1 pound Troy
40	1869 sovereigns
$11 \times 12 \times 40$	12×1869
The answer is $\frac{12 \times 1869}{11 \times 12 \times 40} = £4 \text{ 4s. } 11\frac{1}{2}\text{d.}$	

Thus, in the example already given, 1 oz. of fine gold is the term of demand. 11 oz. fine gold are equivalent to 12 oz. standard gold, 12 oz. standard gold are equivalent to 1 pound Troy standard gold, and 40 pounds Troy standard gold are equivalent to 1869 sovereigns; the last term in the right hand column being arranged to be sovereigns, because the answer is required in sovereigns.

Multiply together all the numbers in the longer column, and divide by the product of the numbers in the other column. This will give the equivalent of the term of demand in terms of the quantity standing lowest in the longer column (in the above example, sovereigns).

N.B. The sloping lines connect quantities of the same kind; the horizontal lines, quantities of equivalent value.

6. The reason of the truth of this rule may be gathered from observing that in reality we multiply the term of demand by a succession of fractions which respectively express the value of one unit of a quantity in terms of the succeeding quantity. Thus we multiply the term of demand, which is 1 oz. fine gold, by $\frac{11}{12}$, the number of ounces of standard gold equivalent to 1 oz. of fine gold. This gives us the amount of standard gold equivalent to 1 oz. of fine gold. We next multiply by $\frac{1}{12}$, which expresses the same quantity in pounds Troy, and next by $\frac{1}{40}$, which is the equivalent of 1 pound Troy of standard gold in sovereigns.

For a more detailed explanation of the rule we refer our readers to Peacock's "Algebra, Vol. I., Arts. 346—353.

We give some additional examples worked out. The reader should carefully in each case examine the reason for the process in the way indicated above.

EXAMPLE 2.—If 7 lbs. of rice be worth 2 lbs. of currants,

3lbs. of currants 1 lb. of hops, 5 lbs. of hops 2lbs. of tobacco at 4s. per lb, what is the value of 1 lb. of rice?

	1 lb. rice.
7	2 lbs. currants.
3	1 lb. hops.
5	2 lbs. tobacco.
1	4s.
105	16

1 $\frac{1}{2}$ shillings = $\frac{1}{2}$ d. = 1 $\frac{1}{2}$ d.—Answer.

EXAMPLE 3.—A certain book is to contain 5 sheets of paper, and 4000 copies are to be printed. Supposing a ream of paper to weigh 24 lbs., what would be the saving upon the expense of publishing the work, owing to a reduction of the price of the paper 1d. per pound?

	4000 copies.
1	5 sheets.
24	1 quire.
20	1 ream.
1	24 lbs.
1	1d. reduction.
24×20	$4000 \times 5 \times 24$
Answer, $\frac{4000 \times 5 \times 24}{21 \times 20}$ d. = 1000d. = £4 3s. 4d.	

EXAMPLE 4.—Find the course of exchange between London and Paris—i.e., the number of francs equivalent to £1—from the following data:—

The market price of standard gold in London is 78s. per oz., and the premium on gold in Paris is 8 francs per thousand.

The *Mint* price of a kilogramme (32.154 oz.) of pure gold in Paris is 3434.44 francs.

	£1
1	20s.
78	1 oz. standard gold.
12	11 oz. fine gold.
32.154	3434.44 francs, mint price.
1000	1008 francs (with premium).
Therefore the Answer is $\frac{1008 \times 3434.44 \times 11 \times 20}{1000 \times 32.154 \times 12 \times 78} = 25.30$ francs nearly.	

Obs. *Fixed Number*.—In the above operation, the only variable quantities are the 78s. expressing the price of gold in London at the time, and the 1008 francs indicating the amount of premium upon gold in Paris at the time.

If we omit these two terms, we get an invariable ratio—

$$\frac{3434.44 \times 11 \times 20}{1000 \times 32.154 \times 12} \text{ or } 1.95822.$$

This being determined, we need only multiply it by the ratio of the two variable quantities, to determine the course of exchange in any given case.

This invariable ratio is called the *Fixed Number*, and is of important practical use in the regulation of exchanges,

KEY TO EXERCISES IN ARITHMETIC.—XL.

EXERCISE 61.

- | | | |
|--|----------------------------|-------------------------|
| 1. 5. | 7. 3 lbs. of the first | 10. (1) 1 gall. of each |
| 2. 15 $\frac{1}{2}$. | two to 4 of the | of the spirits to 3 |
| 3. 25 $\frac{1}{2}$. | last. | galls. of water. |
| 4. 11 $\frac{1}{2}$ shillings. | 8. Equal quantities | (2) 6 galls. of the |
| 5. 4 $\frac{1}{2}$ per cent. | of each. | last to 1 gall. of |
| 6. 2880 $\frac{1}{2}$, 9 $\frac{1}{2}$ ¢. | 9. 21s. 2 $\frac{1}{2}$ d. | each of the others |
| | | and of the water. |

SKETCHING FROM NATURE.—II.

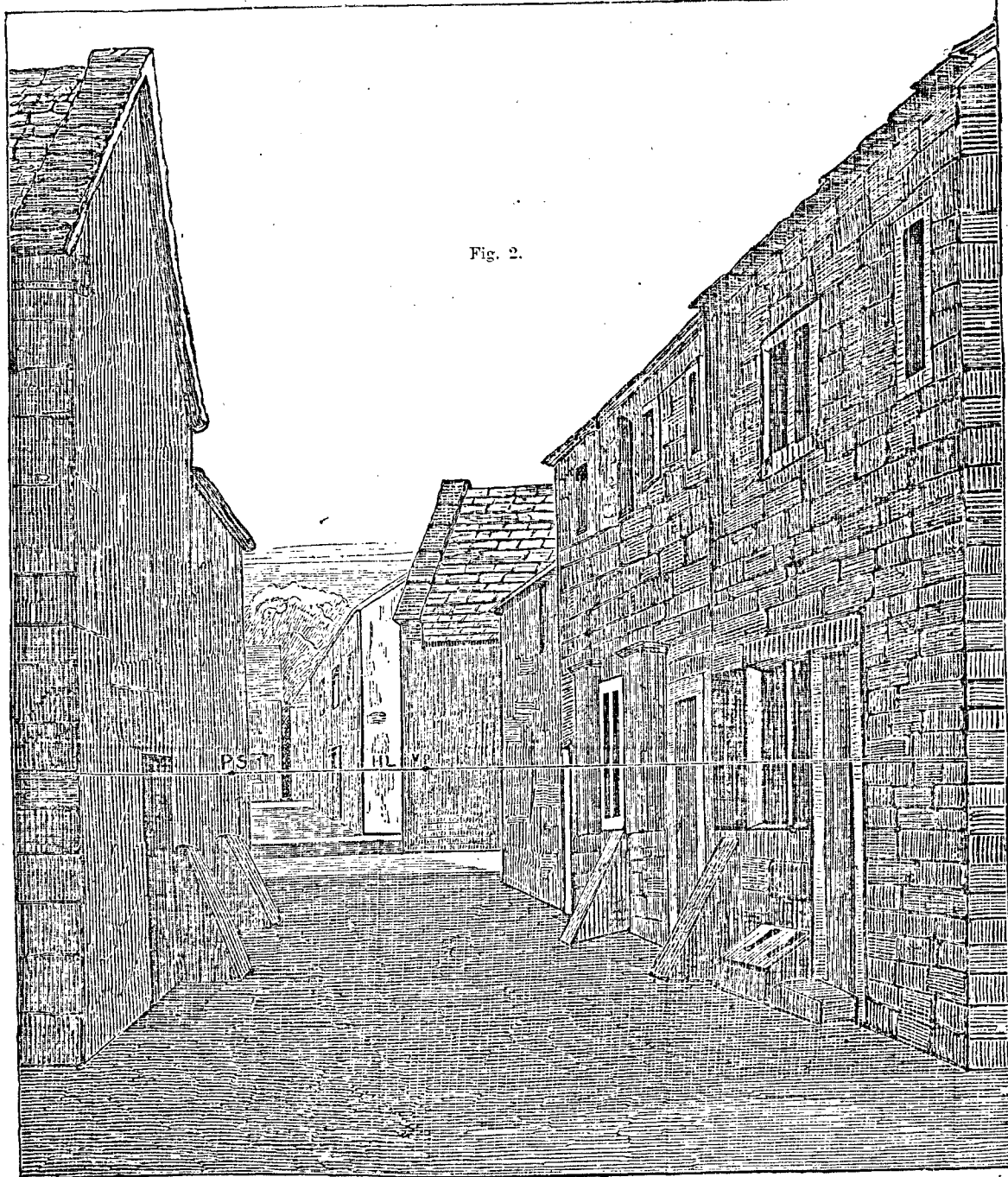
RETIRING LINES—POINT OF SIGHT, ETC.

If our pupils will carefully follow the advice we gave them in the last lesson, and at first strictly confine their attention to very simple subjects, they will soon find themselves in a position to attempt with confidence something more advanced, which will include much that will make a demand upon their knowledge and experience in perspective. When we consider the infinite variety of the positions of lines, and the relations they bear to each other, so many difficulties arise, that we must naturally look about us for assistance altogether independent of mere *manual practice*, of which no amount of experience, however large it may be, can satisfactorily help us, and therefore we must have recourse to perspective. In our very first attempts the one great difficulty presents itself, viz., *how to draw the lines which retire*; here is the starting point from which every rule proceeds, and this difficulty every one will discover immediately he sits down to draw from nature. Objects parallel with our position, or with the picture plane, like the posts in Fig. 1, have no retiring lines—the lines which represent them are either horizontal or perpendicular; if horizontal, they are drawn across the picture, and those which are perpendicular in the object are drawn so. Therefore, with proper attention to the positions and proportions of these lines, exercises of this kind will be found very easy; but when we come to lines in other positions with regard to the picture plane, those which retire—that is, go away from us, like the lines of a railway when viewed from the top of a bridge—other considerations present themselves; lines of this class may retire either horizontally, or at an inclination. Those of our pupils who are accompanying us through the course of "Geometrical Perspective" given in these pages, will not have to be told that there are established rules to aid us in drawing these lines according to the position in which they may be placed; they will be satisfied upon this point, and they will have discovered that by working out these problems their practice in drawing them is rendered easier, and they will have found the result to be satisfactory. We have said before, there is no necessity, even if it were possible, to go through all the geometrical rules that can be applied to the subject when drawing from nature; but we do assert that it is necessary to know them, because, from having practised them upon subjects under given conditions, we can satisfactorily account for the position of every line we draw, let them be placed as they may. There are many who take great delight in drawing from nature, who affirm that perspective is a science not at all necessary to them, although they allow that it is essentially so for architects. This is a mistake, which may be coupled with another, into which they frequently fall, viz., that "it is too difficult to learn." They contend that "if the eye is properly educated, nothing more is required." This vague expression is one we have heard very often, and, of course, many who use it have no definite idea of what they mean by it. We ask such, what they wish us to understand by the "education of the eye?" The eye is not an instrument like the hand, which must have some considerable and practical experience in order to carry out the intentions; the eye has no practical duty to perform, it is simply the medium through which is conveyed to the mind the form, positions, and proportions of the objects to be represented; and since positions and proportions are not arbitrary, it follows that some kind of education is necessary to guide our judgment and practice in dealing with them: in other words, the mind must

be prepared by some process to receive the full impression of everything connected with the object as it stands, or under any condition in which it may be placed, and to recognise details and peculiarities which, without a previous preparation, we should inevitably pass over, totally ignorant of their existence.

it comes to our rescue when doubts arise, all of which can be satisfactorily disposed of by a knowledge of perspective. Without this knowledge, how very discouraging it is when we attempt to draw some large buildings, or a number of them together, to find that we have no principles to guide us, hoping

Fig. 2.



We maintain that a little scientific education reveals facts which would otherwise be lost upon us. Consequently, we assert that the surest and shortest way to "educate the eye" is to educate the understanding, and one of the most effectual means for accomplishing this is the study of geometrical perspective. Experience in this branch of science strengthens our judgment with regard to the true positions of lines, and, more than that,

the drawing may be right in the end, but labouring all the while in the greatest uncertainty, and dreading, at the same time, that should our work come under the inspection of an educated artist, he may detect many faults that might easily have been avoided if we had previously studied the grammar of the art. We do not say this to discourage, quite the reverse; we wish to prove the necessity of the course of study we recom-

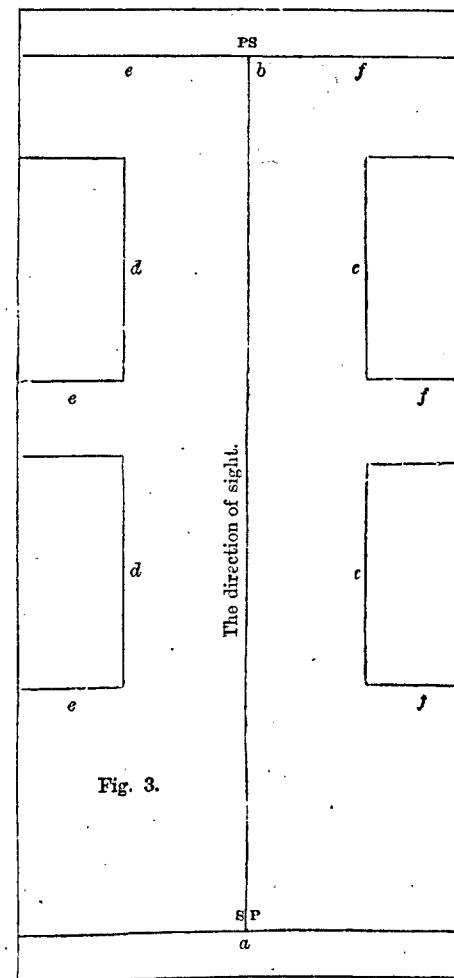
mend; it is short and easy, and we may remark, for the encouragement of the timid, there is no need to carry it to the extent required by architects. As we proceed with our lessons, our pupils will easily find out for themselves how much is requisite, because, according to the class of subject we are drawing, occasions will present themselves which will make it necessary for us to refer to those rules which are applicable to the case, and most of which will be found already given in the previous pages of the POPULAR EDUCATOR.

We will now direct the attention of our pupils to Fig. 2, which is nothing more than an arrangement of straight lines in various directions, each of which, whatever the direction may be, is subject to some especial rule for its treatment. The view

we have selected (and we call it a view, because we wish to talk about it to our pupils as though we were actually out of doors in front of it) is as practical and simple as we could select: it is taken from a small street in one of our Yorkshire towns. We have just said, "it is an arrangement of straight lines in various directions." Now lines in the positions of those which compose our subject are so common, that there will scarcely be found an out-door scene which does not contain them; therefore the observations we are about to make will be found not only applicable to thousands of a similar description, but to numerous others of a much more ambitious character. If we were drawing the interior of a cathedral, we should have to repeat all that we have to say here, with as much more as might be rendered necessary by the different positions of other lines found in the cathedral. Our pupils must now refer back to Lesson III. (Vol. I., page 71), and read again the fixed principles relating to retiring lines and planes, as we are about to show how they may assist us to understand and draw the lines of the houses before us. The instructions we speak of referred more immediately to drawing from copies; we will now make them applicable to drawing from nature; and if they have been clearly understood in the former case, we have an easy task before us. Let us suppose that we are seated opposite the end of the street, at about twenty or thirty yards from the nearest building, and that we have looked it over before we begin, and ascertained which lines retire from, and which are parallel with our position, and have particularly observed the general arrangement and the character of the details. We must first determine the line of sight, or as it is sometimes called, the horizontal line, HL; by holding the pencil horizontally before the eye, and noting the places where it cuts the lines of the subject, it will be seen in our view to cross the door on the right hand at about one-third from the top. This is a very necessary step to take at the commencement, and must not be omitted, when we know that all horizontal retiring lines have their vanishing points on the line of sight. Our next consideration will be, if we find that half of the subject upwards is above the eye (that is, the HL), and the other half below it, then the HL will be drawn across the middle of the paper; if the HL is placed as in the view before us, at about two-thirds from the top of the subject, then the line must be drawn at two-thirds of the distance from the top to the bottom of the paper. Afterwards we must determine the position of the point of sight: this is always opposite the eye

on the line of sight. In general practice we must so place ourselves, when we are looking down a street, that the parallel sides of the street shall be parallel to the imaginary line called the direction of sight, which goes from the eye to the rs—in other words, the sides of the street must retire at right angles with our position. Fig. 3 is a plan representing our position, or station point at *a*; *b* the point of sight opposite the eye; *d c* the sides of the street which, when parallel with each other, and also when they retire directly, or at a right angle from us, have the rs (point of sight) for their vanishing point; the sides *e* and *f* are parallel with our position, and consequently are drawn across the picture. In our view (Fig. 2) *rs* is the point of sight, and all the lines of the buildings on the right vanish at it—viz., the eaves of the roof, the tops and bottoms of the windows, the tops of the doors, the foundation line, and the courses of the bricks, all these lines being parallel with each other, and at right angles with our position. The lines of the building on the left vanish at *vr*, because they do not retire in the same direction, the two sides of the street in this case not being parallel.

It is not a difficult matter to determine precisely where the point of sight is to be found. If the pupil will do as we recommended in the last lesson—that is, hold his pencil between his eye and one of the upper retiring lines, say the eaves, so that the line of the eaves shall coincide with, or be made apparently to lie upon the length of the pencil, and when thus placed, carry his eye downwards along the pencil until it comes to the line of sight—he will find the pencil directed to the point opposite the eye. This can be proved by placing the pencil upon another line which is parallel to the eaves, say the foundation line of the wall; the pencil thus placed will point in the same direction, and it would do the same if it be made to coincide with the tops of the doors, or with any other lines that may be parallel with them. There is another way of proving that the point of sight is the vanishing point for lines going off at a right angle with our position: if we hold out our arm horizontally, and place it in a parallel position with the retiring side of the street, we shall find we are pointing to the point of sight. Let the pupil try this, which he can do in a room, if he places himself in such a position, that on looking before him the direction of sight shall be parallel to the sides of the room on the right hand and the left (see Fig. 3). We shall have to refer to this again when we place ourselves before a subject in which there is a building having an angle towards us, and not a side; we especially request our pupils to read again Lessons in Drawing, III. and IV., Vol. I., pages 72, 103. The first line that the pupil must mark in (we do not advise him to draw any lines until he has first determined the places of all the principal ones) will be the one nearest the *rs*. Let this be the course of procedure in all cases, that is, when arranging the positions of the lines he must begin from the point of sight, and as he passes on, if to the right, mark the place for each line which crosses the line of sight as he comes to it, then take up those lines on the left, commencing from the *rs*, and treat them in the same way; then he must determine the heights of the perpendicular lines drawn through these points of position. He must exercise his judgment in this matter by the comparison of widths and heights in the original.



LESSONS IN LATIN.—XXX.

CONSTRUCTION—DEPONENT VERBS (continued).

I AM about to use the words *construction* and *construed*, and will first explain them. *Construction* (from *cum*, *with*, and *struo*, *I pile*) refers primarily to the putting together of the parts of a building. Hence, in application to composition, it is the putting together of the parts of a sentence. But that putting together in Latin depends on the usages of Latin authors. Those usages we ascertain from their works. Accordingly, a statement of those usages gives the construction, or the proper way of putting words together, in any given case. The construction of *hortor* is the particular kind of words which it takes in connection with itself, and the conditions under which they are to appear. Thus, *hortor* requires its object to be in the accusative case. Consequently, we say that *hortor* is construed with the accusative. This is the application of the word with which we have to do. Another application is, that when to *construe* is used in the sense to *translate*, translation, or putting the sense of a passage from one language into another, is called *construing*, because, in order to translate, you must first ascertain what words are to be taken together, and know how, and according to what rule, they depend on one another.

It is the office of Syntax to give systematic instructions in construction. But the way may be smoothed, and the advantages of repetition gained, if we begin now to supply individual instances.

CONSTRUCTION OF "HORTOR."

Aliquem; *aliquem ad*, *aliquid*; *ut*, *ne*, with the subjunctive; *de aliqua re*, *aliquid*; with the infinitive.

The terms and forms here employed must be explained. This explanation will serve once for all. *Aliquem* means that *hortor* takes an accusative case as its object: for example, *hortor aliquem*, *I encourage some one*: *aliquem ad aliquid* means that, if occasion require, you construe *hortor* thus: *hortor aliquem ad virtutem*, *I encourage some one to (strive after) virtue*. Where observe that *aliquid* is added to show that an accusative case must come after the preposition *ad*. Again, *aliquem in aliquid* means that you may use *in* instead of *ad*: for example, *hortor in praelium*, *I encourage thee towards (for) the fight*. The *ut*, and *ne* mean that with *hortor* these particles are employed, of course, in their proper meaning, and that they require the verb which is dependent on them to be in the subjunctive mood. The rest of the "Construction" will now be readily understood, and I place before you instances.

Hortor with the accusative of the person (*aliquem*):—

"Hæc eo spectant ut te hortor et suadeam."—Cæsar.

Lit. Trans.:—"These things thither look that thee I may encourage and persuade."

Idiomatic Translation:—"I say those things in order to encourage and persuade thee."

Hortor with *ad* or *in*, accusative of the thing:—

"Multæ res ad hoc consilium Gallos hortabatur."—Cicero.

Lit. Trans.:—"Many things to this counsel Gauls encouraged."

Id. Trans.:—"Many things encouraged the Gauls to take this course."

"Et paribus Messapum in prælia dictis hortatur."—Virgil.

Lit. Trans.:—"And with equal Messapus to battle words he encourages."

Id. Trans.:—"And with similar words he encourages Messapus to battle."

This sentence affords an example of the way in which a literal translation may be converted into an idiomatic (correct English) translation, by merely altering the position of the words. In place, *paribus* and *dictis* are wide apart. In matters of this kind, the Latin language gave its writers great latitude. Of this latitude the poets made a free use, as is seen in the line before us. While *paribus* and *dictis* are wide apart in place, they in sense go together; and in making an idiomatic translation, you must put them together. In order to exhibit this to you, I will indicate, by figures, the order in which the words must be taken.

1 6 3 4 5 7 2
Et paribus Messapum in prælia dictis hortatur.
1 2 5 6 7 3 4

These two lines of figures intimate that you may construe the words in either of two ways; as—

1. "And he encourages Messapus to battle with such words."
2. "And with such words he encourages Messapus to battle."

You now have before your eyes an English instance of inversion. In the second of these translations *with such words* is placed early in the sentence, whereas in the first they stand at its close. The first sentence is therefore said to be an inverted sentence, or to have an inversion in it. In English the latitude of inversion is small. It is great in Latin, as is exemplified in the distance at which the adjective *paribus* stands from the noun *dictis* which it qualifies.

If you will compare together my literal translations and my idiomatic translations, you will ascertain that in the second there is often a departure from the construction observed in the first. The construction observed in the first is necessitated by the construction of the Latin: were not the former strictly to follow in form and order the latter, it would not answer the purpose I have in view; namely, first, to show you in English words Latin sentences rendered exactly as they are, or as nearly as may be; and secondly, to lead you, by your comparing the two together, to see how the idioms of the two languages differ. You never can put Latin into English, or English into Latin, with correctness, until you know the peculiarities of the Latin and English idioms, and know also how the one stands relatively to the other. In some cases you will find the idioms of the two languages similar, in others they differ greatly. When the difference is great, great is the difficulty of making a good translation. You will be much assisted in the attempt if you follow the plan I here follow; that is, first make a literal translation, and then make an idiomatic translation. Be sure you compare the two carefully together, and mark how they agree and how they differ. In making the idiomatic translation, observe this rule: keep to the Latin construction as nearly as the English idiom will allow; depart not from the Latin construction unnecessarily; a good translation has two qualities, it is idiomatic, it is close to the original. I now take up the remainder of the construction of *hortor*.

Hortor with the *de* and the ablative:—

"Mandat ut Libonem de conciliandâ pace hortetur."—Cæsar.

Lit. Trans.:—"He gives orders that he may encourage Libo concerning conciliating peace."

Idiomatic Translation:—"He directs him to put Manlius on obtaining peace."

Hortor with *ut* and *ne*:—

"Ille illam hortabatur ut eat, ut properet."—Terence.

Lit. Trans.:—"He her will exhort that she may go, that she may hasten."

Id. Trans.:—"He will exhort her to go, to hasten."

"Hortatur ne sui in perpetuum liberandi occasionem dimittant."—Cæsar.

Lit. Trans.:—"He exhorts that not of themselves in perpetuity of liberating opportunity they may lose."

Id. Trans.:—"He exhorts (them) not to lose an opportunity of gaining perpetual liberty."

Hortor with an accusative of the person and of the thing, two accusatives; or simply with an accusative of the thing:—

"Sin tu (quod te jamdudum hortor) exieris."—Cicero.

Lit. Trans.:—"But if thou (what thee now a long while I advise) shalt go out."

Id. Trans.:—"But if, as I have now long advised thee, thou shalt quit the city."

"Me miseram! Cupio non persuadere quod hortor."—Ovid.

Lit. Trans.:—"Me wretched! I desire not to persuade what I advise."

Id. Trans.:—"Wretch that I am! I desire not to succeed in the advice I give."

Hortor takes also an infinitive mood:—

"Dedit oscula nato, hortaturque sequi."—Ovid.

Lit. Trans.:—"He gave kisses to (his) son, and exhorts (him) to follow."

Id. Trans.:—"He kissed his son, and exhorts him to follow."

If you look back on these translations, you will find that I have rendered *hortor* by different words: as, *encourage*, *advise*, *exhort*. These words, however, resemble each other in signification. They all agree in the root-meaning of the verb *hortor*; which root-meaning is, *I stir up some one to some deed*, *I impel*, *urge*. Thus agreeing, the one or the other may be employed according as the English idiom, a regard to propriety, a regard to sound, or as your own taste may suggest; but observe that whatever word you prefer, it must, at least, in

your literal translations, agree in its essential import with the Latin.

VOCABULARY.

Deficio (de and facio), I fail, swoon.	Etiam atque etiam, again and again.	Jungo, 3, I join, unite (E. R. junction).
Desino, 3, I leave off, cease.	Fuga, -æ, f., flight.	Pareo, 2, I obey.
Desisto (de, from; and sto, stand), 3, I desist, discontinue.	Fugio, 3, I fly from, avoid (E. R. fugitive).	Pudendus, shameful.
Equidem (ego and quidem), I indeed.	Imperium, -i, n., command, govern- ment (E. R.) im- perial.	Superior, -ioris, pre- vious, former.
		Trepidus, trembling, fearful (E. R. intre- pidity).

EXERCISE 108.—LATIN-ENGLISH.

1. Sallustius suos hortatus signum dat. 2. Benefacta tua me hortantur tuo ut imperio paream. 3. Ad laudem milites hortabatur Cæsar. 4. Hortabatur eos in amicitiam jungendam. 5. Isdem de rebus etiam atque etiam hortor, quibus superioribus litteris hortatus sum. 6. Pompeium hortari ut magnam infamiam fugiat non desistimus. 7. Hortatur eos ne animo deficiant. 8. Ego tunc pudendam trepidum hortabar fugam. 9. Equidem pacem hortari non desino.

EXERCISE 109.—ENGLISH-LATIN.

1. The master does not cease to recommend diligence. 2. The master recommended diligence to his scholars. 3. The master having recommended his scholars not to be idle, gave kisses to all. 4. Thy wisdom exhorts me to obey thy government (command). 5. He will advise them to join friendship (to become friends). 6. Thy father encourages thee concerning the same things (on) which I will encourage my brother. 7. I exhort thee not to fail in courage. 8. They have exhorted thy sister not to fail in courage. 9. Never will I advise shameful flight. 10. He never ceases to recommend war.

DEPONENT VERBS.—SECOND CONJUGATION.

I now present to you a view of a deponent verb of the second conjugation; and for this purpose take *vereor*, *I fear*.

EXAMPLE.—*Vereor*, *I fear*.

Chief Parts: *Vereor*, *vereri*, *veritus* sum.

PRESENT TENSE.

Indicative.	Subjunctive.	Imperative.	Infinitive.	Participle.
Sing. Vereor, I fear, etc.	Verear, I may fear, etc.		Vereri, to fear.	Verens, fear- ing.
Vereris.	Verearis.	Verere, verer- tor, Fear thou, etc.		
Veretur.	Vereatur.	Veretur.		
Plu. Vereamur.	Vereamur.	[remior.		
Veremini.	Veremini.	Veremini, re-		
Verentur.	Verentur.	Verentur.		

IMPERFECT TENSE.

Sing. Verebar, I feared, etc.	Vereror, I might fear.		
Vereraris.	Vereraris.		
Vereretur.	Vereretur.		
Plu. Verebamur.	Vereremur.		
Vereremini.	Vereremini.		
Vererentur.	Vererentur.		

FIRST FUTURE TENSE.

Sing. Verebor, I shall fear, etc.	Vereris, I will fear.	Veritum esse, to be about to fear.	Veriturus, about to fear.
Vereris.	Vereris.		
Vereretur.	Vereretur.		
Plu. Verebimur.	Vereremur.		
Vererimini.	Vererimini.		
Vererentur.	Vererentur.		

PERFECT TENSE.

Sing. Veritus sum, I have feared, etc.	Veritus sis, I may have feared.	Veritum esse, to have feared.	Veritus, having feared.
Veritus es.	Veritus sis.		
Veritus est.	Veritus sit.		
Plu. Veriti sumus.	Veriti simus.		
Veriti estis.	Veriti sitis.		
Veriti sunt.	Veriti sint.		

PLUPERFECT TENSE.

Sing. Veritus eram, I had feared, etc.	Veritus essem, I might have feared.		
Veritus eras.	Veritus esses.		
Veritus erat.	Veritus esset.		
Plu. Veriti eramus.	Veriti essemus.		
Veriti eratis.	Veriti essetis.		
Veriti erant.	Veriti essent.		

SECOND FUTURE TENSE.

Sing. Veritus ero, I shall have feared, etc.	
Veritus eris.	
Veritus erit.	
Plu. Veriti erimus.	
Veriti eritis.	
Veriti erunt.	

GERUNDS.

Gen. Verendi, of fearing.	
Dat. Verendo, to fearing.	
Acc. Verendum, to fear.	
Ab. Verendo, in fearing.	

SUPINES.

1. Veritum, to fear.	
2. Veritum, to be afraid.	

Like *vereor*, form *mercor*, 2 (*mereri*, *meritus* sum), *I earn*, *gain by my deserts*; *misereor*, 2 (*misereri*, *miseritus* sum), *I pity* (E. R. *commiserate*), takes a genitive; *tueor*, 2 (*tueri*, *tuitus* sum), *I watch*, *guard*; *fateor*, 2 (*fateri*, *fassus* sum), *I confess*, *admit*.

KEY TO EXERCISES IN LESSONS IN LATIN.—XXIX.

EXERCISE 104.—LATIN-ENGLISH.

1. My friends cannot be received in one house. 2. Tell us, by what consolation the troubled mind of the friend has been soothed? 3. The narrow limits of your breast cannot contain so great a character. 4. Nor will the world contain thee. 5. I must take food (food must be taken by me). 6. You must teach. 7. Teaching boys, you will be much loved. 8. Say why the boy has been punished? 9. The war came to an end. 10. See that the state receives no injury (not anything of injury). 11. Tell me, what has been written to you by your sister? 12. No vice is more vile than avarice, especially in rulers who manage (managing) the state. 13. Thinking of heavenly things, we despise these our own as insignificant. 14. The class of men who reproach (reproaching) kind actions is hateful. 15. A draught of cold water is hurtful to one sweating from the effect of labour. 16. A good man assists a good man without his entreating it. 17. Storks, about to migrate into foreign lands, are assembled in one spot. 18. A great multitude of men are collected in the city, for the purpose of seeing the public games. 19. All griefs (which are) borne patiently are less bitter. 20. The general dismisses the soldiers, after praising them (having been praised) on account of their distinguished valour. 21. Many youths, having been badly educated in their early boyhood by their parents, rush to destruction. 22. In the reign of Xerxes (Xerxes reigning) the Greeks obtained a most splendid victory over the Persians. 23. There is friendship between good men and God, nature uniting them. 24. When winter approaches (winter approaching) many birds seek milder regions. 25. Peace being recovered, the arts flourish. 26. When kings were banished (kings being banished), the Romans laid the foundation of a free state. 27. Though the country is changed (the country being changed), the characters of men are not changed. 28. Since the laws of God have been religiously observed (the laws of God having been religiously observed), our life will be happy.

EXERCISE 105.—ENGLISH-LATIN.

1. Veri amici angustâ domo capi possunt. 2. Non capiunt angustiam hujus domus tantam personam. 3. Dic mihi quid pater tibi dixerit. 4. Fer matri aquam. 5. Avaritia in parentibus domos gerentibus magnam vitium est. 6. Avaritiâ deletâ, vitium deletum est. 7. Cogitans patriam, miles perit. 8. Timenti amicus magnæ consolationi est. 9. Republicâ turbatâ, quis beatus esse potest? 10. Ingens hominum multitudo venerunt, potitura vinum. 11. Milites laudati, dimissi sunt. 12. Regnante Victoria, Educator Popularis institutus est. 13. Libro mutato, non sententias mutas.

EXERCISE 106.—LATIN-ENGLISH.

1. Who does not admire the splendour and beauty of virtue? 2. The general encouraged the soldiers to attempt to throw into confusion the enemies' line. 3. Already the enemies attempted to attack the city, when suddenly they were driven back by the citizens. 4. When you have despised pleasure, then, at length, you will be happy. 5. Survey the noble examples of virtue which have been recorded in history. 6. I come to accompany you into the garden. 7. Dreams are difficult to be explained. 8. Socrates accounted himself an inhabitant and a citizen of the whole world. 9. Learn willingly (being willing). 10. What is sweeter than to learn many things. 11. Riches accompany a learner, honours accompany (a learner). 12. The wicked man will at length remember his vices with grief.

EXERCISE 107.—ENGLISH-LATIN.

1. Mulierum pulchritudinem admiratus sum. 2. Hominem hortati sunt. 3. Rex milites hortabatur ut hostes propulserent. 4. Improbum pater filium arbitrabatur. 5. Quis signa interpretabatur? 6. Tumdemum Dei signa interpretaberis, quum sapiens et bonus eris. 7. Virtutis exempla facilia sunt interpretata. 8. Ille me in orto comitabatur, quum tu venisti. 9. Eo patrem comitatum. 10. Pater me in provinciam comitatum venit. 11. Honores bonos et sapientes comitabantur. 12. Pueri, discite libentes, et admiratione afficiemini.

THE UNIVERSITIES.—I.

OXFORD.—I.

THE advantages offered by the University of Oxford are available to two classes of persons—namely, those who do, and those who do not, become members of it. A practical account of the University, written from a popular point of view, naturally embraces the following heads:—

I. Advantages offered to Unmatriculated Persons.

The Local, Middle-Class, or Non-Gremial Examinations.

II. Advantages and Conditions of the University Curriculum.

i. The course open to students described in the University statutes as *non ascripti*, more commonly known as unattached students.

ii. Private halls.

iii. Collegiate education.

I. THE LOCAL EXAMINATIONS.

These Examinations, which were instituted by a statute passed, after much discussion and careful revision, in 1858, have for their object the award of certificates of merit to such candidates, of either sex, as satisfy their requirements, which may serve as some introduction and recommendation for their holders on entering into trade, mercantile pursuits, or other avocations in life. There are two classes in these examinations—one for senior, and one for junior candidates. For the seniors there is no limit of age; but successful candidates under nineteen receive certificates conferring the title of Associate of Arts, while successful candidates over nineteen receive pass certificates only. Junior candidates must be under sixteen years of age. There are also higher examinations, restricted to women.

The subjects in the last papers obtainable are given in parentheses when necessary, as a fair sample of the average examination. The subjects vary, but the leading principles of the examination remain unchanged.

REGULATIONS FOR JUNIOR CANDIDATES.

The 1st day of July is the limit which determines the eligibility of junior candidates of either sex for admission.

For the convenience of candidates two examinations are usually held, one in June and one in July.

(i.) Preliminary Subjects.

Every candidate will be required to satisfy the examiners in—1. Reading aloud a passage from some English author. 2. Writing from Dictation. 3. English Grammar and Composition, including passages for parsing, paraphrase, and explanation; together with a short English Composition. 4. Arithmetic: Numeration, the first Four Rules, simple and compound, Reduction, Vulgar and Decimal Fractions, and the single Rule of Three. The quality of the handwriting and the spelling will be taken into account.

(ii.) Optional Subjects.

In addition to the above necessary subjects, without proficiency in all of which no certificate will be awarded, candidates will be required to satisfy the examiners in three at least of the following nine subjects, namely:—1. Religious Knowledge. 2. English. 3. Latin. 4. Greek. 5. French. 6. German. 7. Mathematics. 8. Mechanics and Mechanism. 9. Chemistry. No candidate will be examined in more than six of these. All candidates must be examined in at least one of the divisions of Religious Knowledge, unless their parents or guardians object to this part of the Examination.

1. *Religious Knowledge.*—(a) The First Book of Kings; (b) the Gospel according to St. John, or the Gospel according to St. Matthew; (c) the Acts, i.—xii.;* (d) the Catechism. Opportunity will be given for showing knowledge of the Greek Text of the New Testament.

No candidate will pass in Religious Knowledge who does not satisfy the examiners in two of these divisions. No candidate will be examined in more than three.

2. *English.*—(a) The Outlines of Greek History from 510—404 B.C., with special questions on the Persian War, and the Outlines of Roman History from 509—242 B.C., with special questions on the First Punic War; (b) the Outlines of English History from the Norman Conquest to the Battle of Waterloo, with special questions on the period from 1603—1643; (c) Shakespeare's "Julius Cæsar"; (d) Physical, Political, and Commer-

* The books given in (a), (b), and (c) vary from year to year.

cial Geography. An Outline Map of some special country will also be given to be filled up.

No candidate will pass in *English* who does not satisfy the examiners in two of the four divisions (a), (b), (c), (d). No candidate will be examined in more than three of them, or be allowed to take (a) and (b) together.

3. *Latin.*—Passages will be given from a prose and a verse author (as, for example, Cæsar, "Bell. Gall." iii., iv., and Horace, "Odes" iii.) for translation into English, with grammatical and general questions. Candidates may take either of the two authors, but no candidate will be examined in both.

An easy passage from some other Latin author will be set for translation into English. A few easy English sentences to illustrate common Latin constructions, and a short passage from some English writer will be given for translation into Latin.

4. *Greek.*—Passages will be given from a prose and a verse author (as, for example, Xenophon, "Cyropædia," iv., and Homer, "Iliad" i.) for translation into English, with grammatical and general questions. Candidates may take either of the two authors, but no candidate will be examined in both.

An easy passage from some other Greek author will be set for translation into English.

5. *French.*—A passage will be given from a standard French author (Quinet's "Lettres à sa Mère") for translation into English, with grammatical and general questions. A passage from a French newspaper will be set for translation into English, and English sentences for translation into French.

6. *German.*—A passage will be given from a standard German author (Schiller's "Historische Skizzen") for translation into English, with grammatical and general questions. A passage from a German newspaper will be set for translation into English, and English sentences for translation into German.

7. *Mathematics.*—No candidate will pass in this subject who does not show a fair knowledge of Euclid, Books i. and ii., and of Algebra to Simple Equations, including Addition, Subtraction, Multiplication, Division, Greatest Common Measure, Least Common Multiple, Fractions, Extraction of Square Root, and Simple Equations containing one or two unknown quantities and problems producing such equations.

Questions will also be set in the following subjects:—(1) Higher Arithmetic; (2) Euclid, Books iii., iv., vi.; (3) Quadratic Equations, Progressions, and Proportions; (4) Plane Trigonometry, including Solution of Triangles, and the use of Logarithms; (5) Mensuration. No credit will be given for a slight knowledge of any of these subjects. The answers should be illustrated by diagrams, where these can be introduced. Euclid's axioms will be required, and no proof of any proposition will be admitted which assumes the proof of anything not proved in preceding propositions of Euclid.

8. *Mechanics and Mechanism.*—The questions will be of an elementary character, extending, in Statics, to the Composition and Resolution of Forces, the determination of the Centre of Gravity in simple cases, and the Mechanical Powers; in Dynamics, to Impact and Collision, the Motion of Falling Bodies, and Atwood's Machine; in Hydrostatics, to the Pressure of Fluids, and the ordinary Hydrostatic and Pneumatical Instruments.

The answers should be illustrated by diagrams, where these can be introduced.

9. *Chemistry.* including the elementary facts of Chemistry, as illustrated by the following elements and their combinations:—Oxygen, Hydrogen, Nitrogen, Carbon, Chlorine, Iodine, Sulphur, Phosphorus, Potassium, Sodium, Calcium, Iron.

There will also be a practical examination in the analysis of simple salts (consisting of one acid and one base). Candidates must satisfy the examiners in the practical examination in order to pass in this subject.

(iii.) Candidates may also offer themselves for examination in—

1. *a.* Drawing from the Flat.

b. Drawing from the Solid, with light and shade.

2. *Music.*—Questions will be set on Notation, Intervals, Scales, Time, and Rhythm, Signs and Marks of Expression, the Common Chord and its inversions, the Dominant Seventh and its inversions. A short and simple figured bass may be given to be harmonised in accordance with elementary rules.

The results of the examination held in June and of that held in July are combined, and the names of all the successful candidates are published in one list, arranged in three divisions; those in the

first and second divisions are placed in order of merit; those in the third division in numerical order under the several centres.

Certificates are issued to the successful candidates, specifying the subjects in which they satisfied the examiners, and the division in which their names are placed. Lists are published of the candidates who distinguish themselves in each of the subjects from 1 to 9 inclusive, provided that they also obtain certificates. The names are arranged in order of merit.

REGULATIONS FOR SENIOR CANDIDATES.

Persons of either sex will be admitted without limit of age to the examination of senior candidates. Successful candidates born on or after July 1st, 1867, will receive certificates conferring the title of Associate of Arts. Successful candidates born before that date will receive pass certificates.

(i.) Preliminary Subjects.

Every candidate will be required to satisfy the examiners in—1. English Grammar, Analysis, and Composition. 2. Arithmetic. The quality of the handwriting and the spelling will be taken into account.

(ii.) Optional Subjects.

The examination will comprise the following sections:—

(a) Religious Knowledge; (b) English; (c) Languages; (d) Mathematics; (e) Natural Science; (f) Drawing; (g) Music.

Every candidate will be required to satisfy the examiners in two at least of the sections (a), (b), (c), (d), (e), but if both (a) and (b) are offered they will also be required to satisfy the examiners in either (c), (d), or (e). No candidate will be examined in more than five of the sections (a), (b), (c), (d), (e), (f), (g). All candidates must be examined in one at least of the divisions of Religious Knowledge, unless in the case of candidates born on or after July 1st, 1867, their parents or guardians object to this part of the examination, or in the case of candidates born before that date, the candidates themselves so object.

Section A.—Religious Knowledge.

1. The First Book of Kings. 2. The Gospel according to St. John, or the Gospel according to St. Matthew. 3. The Acts, i.—xii. 4. The Epistle to the Galatians and the First and Second Epistles to the Thessalonians.† 5. The Catechism, the Morning and Evening Services, and the Litany and the outlines of the History of the Book of Common Prayer.

Opportunity will be given for showing knowledge of the Greek text of the New Testament. No candidate will pass in Religious Knowledge who does not satisfy the examiners in two of these divisions. No candidate will be examined in more than three.

Section B.—English.

1. The outlines of Greek History from 510—404 B.C. with special questions on the Persian War, and the outlines of Roman History from 509—242 B.C., with special questions on the First Punic War.

2. *English History*, from 1603—1648, and the outlines of the History of English Literature during the same period, together with the general outlines of English History from the Norman Conquest to the Battle of Waterloo.

3. Shakespeare's "Julius Cæsar," and Johnson's "Lives of Pope and Dryden."†

4. *Physical, Political, and Commercial Geography.* An outline map of one of the following will also be given to be filled up—viz (1) England and Wales; (2) Scotland; (3) India; (4) Egypt, Syria, and Asia Minor; or (5) North America.

5. The elements of *Political Economy*.

No candidate will pass in this section who does not show a fair knowledge of two of these five divisions. No candidate will be examined in more than three of them, or be allowed to offer 1 and 2, or 4 and 5, together.

Section C.—Languages.

1. *Latin.* 2. *Greek.* 3. *French.* 4. *German.* 5. *Italian.* No candidate will pass in this section who does not show a fair knowledge of one of these languages. No candidate will be examined in more than four of them. French and Italian may not be taken together.

Candidates who offer Latin will be examined in Livy, Book vi., and Horace, "Od." ii., iii.,† and those who offer Greek, in Xen.,

* Candidates may not offer both French and Italian; or both Music and Physics; or both Greek and Botany, Zoology, or Geology.

† The books given vary from year to year.

"Cyropædia," iv., v., or in Thucydides, Book vii., and Euripides, "Alcesteis." In other languages no books are prescribed.

In each of the five languages questions on Grammar will be set, and passages will be given both from unprepared books for translation into English, and of English for translation into Latin, French, German, or Italian, as the case may be.

Section D.—Mathematics.

Pure Mathematics to Algebraical Geometry, inclusive, *Mechanics* (including Mechanism), and *Hydrostatics*.

No candidate will pass in this section who does not show a fair knowledge of four books of Euclid, and of Algebra to the end of Quadratic Equations, comprising Addition, Subtraction, Multiplication, and Division of Algebraical Quantities (including simple irrational quantities expressed by radical signs or fractional indices), Greatest Common Measure and Least Common Multiple, Fractions, Extraction of Square Root, Simple Equations, containing one or two unknown quantities, Quadratic Equations containing one unknown quantity, questions producing such equations, and the simplest properties of Ratio and Proportion. The answers should be illustrated by diagrams, where these can be introduced.

Euclid's axioms will be required, and no proof of any proposition will be admitted which assumes the proof of anything not proved in preceding propositions of Euclid.

Section E.—Natural Science.

1. *Physics.*—(a) The elementary properties of matter in its solid, fluid, and gaseous forms; density, mass, gravity, weight, specific gravity and inertia; composition of two forces; centre of gravity; pressure of fluids; laws of motion; construction and use of simple mechanical, hydrostatical, and hydraulic machines. (b) Elements of Heat. (c) Elements of Electricity and Magnetism. No candidate will pass in this subject who does not show a fair knowledge of (a), and of either (b) or (c). No candidate will be examined in (b) and (c) together. Physics and Music may not be taken together.

2. *Chemistry*, including the facts and general principles of Chemical Science. There will be a practical examination in the elements of Analysis. Candidates must satisfy the examiners in the practical examination, in order to pass.

3. (a) *Botany*, including Elementary Vegetable Physiology and the types of the chief divisions of the Vegetable Kingdom; (b) *Zoology*, including Elementary Animal Physiology and the types of the Animal sub-kingdoms; (c) *Geology and Mineralogy*.

No candidate may offer more than one of these subjects (a), (b), or (c). No part of 3 may be taken with Greek.

No candidate will pass in this section who does not show a fair knowledge of one at least of the divisions 1, 2, 3. In all cases a practical acquaintance with the subject-matter will be indispensable. The answers should be illustrated by diagrams and drawings, where these can be introduced.

Section F.—Drawing.

1. *Drawing from the solid*, with light and shade. 2. *Drawing in perspective*. 3. *Drawing in colour* from a natural object. 4. *Drawing from memory*.

No candidate will pass in this section who does not satisfy the examiners in drawing from the solid.

Section G.—Music.

In addition to a thorough knowledge of the subjects prescribed for Junior candidates, the Seniors must show an acquaintance with the chords of the Added Ninth and Minor Ninth and their inversions, and must be able to harmonise a figured bass, introducing these chords. They may be called upon to add three parts to a given melody.

The results of the examination held in June and of that held in July will be combined.

The names of all the successful candidates born on or after July 1st, 1867, will be published in one list, arranged in three divisions, the first and second divisions in order of merit, the third in numerical order under the several centres. Lists of those who distinguish themselves will also be published for each of the sections A, B, C, D, E, F, G, arranged in two divisions. The names in each first division will be placed in order of merit; those in each second division alphabetically.

Certificates, signed by the Vice-Chancellor, will be issued to the successful candidates, conferring the title of Associate in Arts, and specifying the subjects in which they satisfied the

examiners, and the division or divisions in which their names are placed. The names of all the successful candidates born before July 1st, 1867, will be published in a separate list, arranged in numerical order under the several centres, and pass certificates, signed by the Vice-Chancellor, will be issued to them, specifying the subjects in which they satisfied the examiners.

Those candidates who show sufficient merit in translations from Latin and Greek authors, in Grammar, in Latin Prose Composition, and in Mathematics, to be excused from Responsions, may receive a certificate from the delegates to that effect.

Candidates will be examined in Oxford, and in such other places as the delegates may from time to time appoint.

For examination in Oxford, and for list of local secretaries, application should be made to the secretary to the delegacy at Oxford. Every candidate is required to pay a fee of 20s.

HIGHER EXAMINATION FOR WOMEN.

This consists of a First Examination and a Second Examination, both of which cannot be taken in one year. The first examination is held in June and December, the second in June only. No candidate is admitted to the Second Examination unless she has passed the First Examination, or some other accepted by the delegates as equivalent. Among these equivalent examinations are the Matriculation Examination at London; the Cambridge Higher Local Examination, if candidate has passed in Group C, and in two languages of Group B; Oxford Senior Local Examinations, if candidate has passed in Section D, and, with special recommendation of examiners, in two languages of Section C.

In the First Examination candidates must satisfy the examiners in—

- i. Any two of the following Languages (a) Latin; (b) Greek; (c) French or Italian; (d) German.
- ii. Arithmetic.
- iii. (a) Euclid (first two books); or Algebra to Simple Equations, inclusive.

The Second Examination consists of a Pass Examination and an Examination for Honours.

The Pass Examination comprises the following sections:—

- a. Two Languages (as in First Examination).
- b. Ancient History (Greek and Roman).
- c. Modern History.
- d. Mathematics.
- e. Physical Science. (Physics and Chemistry; but Elementary Biology and Geology may be offered in addition.)
- f. Logic and Political Economy.

Candidates will not satisfy the delegates unless they pass, at the same examination, in Section a and in at least one of the other sections, but candidates who have so passed may offer any of the other sections at a subsequent examination. No candidate is examined in more than two sections at any one examination.

The examination for Honours includes the following eight sections, but no candidate is examined in more than one of these sections at the same examination:—1. English; 2. Latin and Greek; 3. Modern Languages (German, French, Italian, and Spanish); 4. Mathematics, Pure and Mixed; 5. Ancient History, with Latin and Greek texts; 6. Modern History, with original texts; 7. Mental and Moral Philosophy; 8. Physical Science.

The fee payable for the First or Preliminary Examination is £2; and £2 10s. for the Pass Examination. For the Honours Examination the fees are from 10s. to £2 10s. per subject. All further particulars may be obtained from the Secretary to the Delegacy for Local Examinations, Oxford.

LESSONS IN GEOGRAPHY.—XXX.

ASIA (continued).

THE *Peninsulas* of Asia are:—Arabia, which lies between the Red Sea and the Persian Gulf; Asia Minor, between the Black Sea and the Mediterranean Sea; India, or Hindostan, between the Arabian Sea and the Bay of Bengal; the Eastern Peninsula, or Further India, and its branch, the Malay Peninsula, between that bay and the Chinese Sea; Corea, between the Yellow Sea and the Sea of Japan; and Kamtschatka, between the Sea of Okhotsk and Behring Sea. The *Isthmus* which unites Malacca, or the Malay Peninsula, to the Eastern or Indo-Chinese Peninsula, is called the Isthmus of Kra.

The *Capes* of Asia are:—In Asia Minor, Cape Baba, near the ruins of Troy, and Cape Anamour, in south of Asia Minor; Cape

Andrea, in Cyprus, and Cape Beyrout, or Beirut, in Syria. In Arabia, Cape Amran, near Aden, Cape Fartak, and Cape Ras-al-Had, the most eastern point of that peninsula; in Southern India, or the Western Peninsula, Cape Comorin, the most southern point of Hindostan; and Point Calimere, on the Coromandel coast. In the Eastern Peninsula, Cape Negrais, on the coast of Ava; Point Romania, in the south of Malacca, or the Malay Peninsula; Cape Cambodia, and Cape Padaran, projecting into the Gulf of Siam and the Chinese Sea; on the eastern coast of China, the promontory of Shantung; in Kamtschatka, Cape Lopatka; and at Behring Strait, the East Cape. The principal cape in the Arctic Ocean is Cape Severo Vostochnoi, or N.E. Cape.

In Asia there are many vast *Lakes* which deserve and have received the name of seas. Of these, the principal is the Caspian Sea, between Russia and Turkestan, said to be more than 700 miles long; it covers a surface of about 140,000 square miles, and varies in depth from 12 feet on its northern shores, to 150 feet on its other shores; being about 2,800 feet deep in the middle. This inland sea is salt, but less so than the great ocean which surrounds the continent; it lies in a basin whose surface is lower than that of the sea in general, having been ascertained to be about 83 feet lower than that of the Black Sea. The Sea of Aral, in Turkestan, is about 300 miles long; it covers a surface of about 23,000 square miles, being shallow and slightly salt—this lake is 117 feet above the level of the Caspian Sea. The Lake Baikal, in Siberia, is about 350 miles long, and varies from 35 to 60 miles in breadth; it covers a surface of about 25,000 square miles, and is raised about 1,400 feet above the level of the sea; its waters are fresh, and abound in fish. Other lakes of smaller size, but still occupying a large surface, are: Balkash or Tengiz, in the south of Russia in Asia; Zurrak, in Afghanistan; Tengri-Nor, in Chinese Tibet; Baktegan, in Persia; the Dead Sea or Lake Asphaltites, in Palestine; and many others in this vast continent. The most elevated piece of water on the earth's surface is Lake Sir-i-kol, one of the principal sources of the Amoo-Daria or Oxus, in the Bolor-Tagh Mountains.

Asia contains the most extensive plateau or *table-land* to be found on the surface of the globe. It lies generally between the parallels of 30° and 50° north latitude, and between the meridians of 70° and 120° east longitude; its length is about 2,500 miles, and its breadth varies from 1,200 to 1,400 miles. Its mean elevation above the level of the sea is about 2,000 feet. The plateau of Mongolia is about 3,000 feet in elevation; and the loftiest parts of the plateau of Tibet reach the amazing altitude of 16,000 feet. Between these plateaus lies the Great Sandy Desert of Tartary, called Gobi (*desert*) or Shamo (*sea of sand*), having an average elevation of 2,500 feet above the level of the sea. The plateaus of Persia and Afghanistan are of less elevation than those of Tibet; the former being, on an average, 3,500 feet high, and the latter 6,000 feet high. The high table-land of Armenia, upon which the ark of Noah is said to have rested, is about 6,000 feet in elevation; and that of Asia Minor varies from 6,000 to 3,000 feet. In India, to the south of the great table-land region, are the plateaus of Malwa, the Deccan, and Mysore; the two former being each 2,000 feet, and the latter 3,000 feet in elevation above the level of the sea. The table-land of Arabia, which was formerly supposed to be one vast desert in the interior, has an average height of 3,500 feet.

The great *plains* and *lowlands* of Asia form a balance and counterpart to the *mountains* and *table-lands* of that continent. The plain of Siberia in the north extends from the foot of the Uralian mountains, between the shores of the Arctic Ocean and the bottom of the great Altaian range of mountains, to the most eastern extremity of the continent. The plain of Independent Tartary extends from Siberia, on the south-west, to the high table-land of Persia, including the Sea of Aral. The plain of China, which extends 500 miles inland from the East and Yellow Seas, is well watered and cultivated, and very populous; the plains of Further India partake of the same character; and the plain of Hindostan, which divides the plateaus of Southern India from the Himalaya Mountains, is the land of rice, sugar, indigo, and cotton. The great mid-river plain of India, the space between the Indus and the Ganges, includes the preceding fertile tract, the great Indian Desert, and the plain of Sind or Scinde, which, embracing the lower course of the Indus, is very fertile. The plains of Mesopotamia (in the middle between the rivers), now called *Al-jeriah*, and Babylonia, now called *Irak-Arabi*, include the greater part of the countries watered by the rivers

Tigris and Euphrates. The so-called Mesopotamian or northern plain is rather barren; but the southern or Babylonian plain, extending to the Persian Gulf, is much more productive, and formerly supported a much larger population than at present.

In Asia are to be found the loftiest *mountains* on the surface of the globe, as well as vast *plateaus* and immense *deserts*.

The *mountain systems* of Asia diverge and extend in all directions from a great mountain mass or knot, which stands in the centre of the continent, and rises above the lofty table-land of Pamir to a height of 19,000 feet above the level of the sea. This range, which forms part of the natural boundary line between Turkestan or Independent Tartary, and Chinese Turkestan, is called the Bolor-Tagh Mountains.

From the northern extremity of this short but lofty range, the Thian-Shan Mountains run in a north-east direction between Independent Tartary and Chinese Tartary, sending out a long branch to the east towards Mongolia. The culminating peak of these mountains is Tangri-Khan, 21,000 feet in height. The range also contains two lofty volcanoes, Po-shan and Ho-tschou.

At the northern extremity of the main branch of the Thian-Shan Mountains stands the Lake Sir-i-kol, encircled along its northern shore by the Ala-Tau range. This range is prolonged in a north-easterly direction to the eastern extremity of Asia, under the names of the Altai, Sayansk, Yablonoï, Stanovoi, and Aidan Mountains. The culminating point of this long chain of mountains, whose different portions are distinguished by the names that have just been enumerated, is Mount Katunsk, a peak of the Altai Mountains, which is 12,790 feet above the sea-level. A branch of the Aidan Mountains extends southwards through the peninsula of Kamtschatka, in which are several lofty volcanoes. The highest of these is Kliutchevskaja, 15,765 feet in height. The remaining mountains of importance in Russia in Asia are the Orulgan Mountains, on the east of the river Lena and the Baikal Mountains, to the west of Lake Baikal.

Returning to the central mountain mass of Asia, the Bolor-Tagh Mountains, we find the Kuen-Lun Mountains branching out in an easterly direction from its southern extremity, and separating Chinese Tartary from Tibet. This is succeeded by the Pei-ling range, between the rivers Hoang-ho and Yang-tse-kiang, in China, which sends out many spurs and branches to the north and south, namely, the In-shan and Khin-gan Mountains, in Mongolia, and the Yun-ling range, between China and Tibet, and Nan-ling range, in the south of China.

Again, going back to the Bolor-Tagh Mountains, we find the Himalaya Mountains trending in a south-east direction from its southern extremity, and separating Hindostan from Tibet. In this range are the loftiest peaks on the world's surface, the principal being Dhawalagiri, in Nepal, 28,080 feet high; Kunchinjunga, in the little state of Sikkim, between Nepal and Bhotan, 28,150 feet high; and Gaurisankar or Mount Everest, between Tibet and Nepal, 29,002 feet high. The Karakorum Mountains, in Tibet, form a sort of offset of the Himalaya range to the east, having Dapsang, 28,280 feet high, as the culminating point. In Burmah are the mountains of Aracan, while Further India is traversed by ranges running parallel to the courses of its great rivers, and extending along the whole length of the Malay Peninsula. These last-named ranges are of no great height, Tidi-bang-sa, in the Malay Peninsula, 6,560 feet in height, being their culminating point. The Vindhya Mountains traverse the centre of the peninsula of Hindostan in a direction almost east and west, while the sides of the peninsula slope to the sea in ranges parallel to the coast, and called, from their position, the Eastern and Western Ghauts.

Once more reverting to the Bolor-Tagh Mountains, we see the Hindoo-Koosh Mountains, branching from the southern extremity of this central mass in a south-west direction, dividing Independent Tartary from Cashmere, in the north of Hindostan, and Afghanistan, and extending far into the interior of this last-named country; the Suliman Mountains, a branch of the Hindoo-Koosh Mountains, extending first to the east and then to the south, separating Afghanistan and Beloochistan from Hindostan, or the peninsula of India.

Extending through the north of Persia, from the Hindoo-Koosh Mountains towards the west, are the Paropamisian Mountains and Elburz range, the former having its culminating point in Koh-i-baba, 16,000 feet high, and the latter in Mount Demavend, about 21,500 feet above the sea-level. Through the western and southern districts of Persia stretch the Zagros

Mountains, or mountains of Kurdistan, in a direction parallel with the Euphrates and Tigris, and forming the north-east limit of the great plain through which those rivers run.

Lastly, considering the Ural Mountains and the Caucasus range to be common to Europe and Asia, as they form part of the line of demarcation between these continents, there are yet remaining to be named, as Asiatic mountain ranges, the mountains of Armenia, culminating in Mount Ararat, 17,112 feet in height, and lying south of the Caucasus, between the Black and Caspian Seas; Taurus and Anti-Taurus, in Asia Minor, culminating in Argish Dagh, 13,197 feet high; and the Lebanon Mountains, running along the coast of Syria and Palestine as far as the peninsula of Sinai, and culminating in Mount Hermon, which is in the north of Palestine, and 9,375 feet above the sea-level.

Of the mountains in the islands of Asia, the most worthy of notice are Fusi-yama or the mountain Fusi, an active volcano, in the island of Nippon, Japan, to the west of the capital, Yeddo or Jeddo; and the mountains in the south of Ceylon, which culminate in the peak of Pedrotallagalla, about 8,280 feet above the level of the sea.

The *rivers* of Asia exceed in magnitude and extent any of the rivers of Europe, and are themselves only surpassed by those of America. These large rivers have their sources in the mountains which border the immense plateaus already described, and they flow through the plains northward, eastward, and southward, into the surrounding oceans. In the Altai Mountains rise the large rivers, Obi, Yenisei, and Lena, which, after traversing the plains of Siberia for the respective direct lengths of about 1,800, 1,950, and 1,300 miles, fall into the Arctic Ocean. The Obi is said to drain a surface of 925,000 square miles. In the mountains of China, and the Chinese empire, rise the Amour, or Sagalien, which, after a course of about 1,250 miles, falls into the Sea of Okhotsk; the Hoang-ho, or Yellow River, which, after a course of about 1,150 miles, falls into the Yellow Sea; the Yang-tze-kiang, or Kiang-ku, which, after a course of about 1,800 miles, falls into the same sea; and the Choo-Kiang, or river of Canton, which, after a course of about 580 miles, falls into the Chinese Sea. In the eastern peninsula run the rivers called the Song-ha, the Ma-kiang or Camboja, the Moïnam, the Salween or Saluen, and the Irrawaddy; these fall respectively into the Gulf of Tonquin, the Chinese Sea, the Gulf of Siam, and (the two last-named) the Gulf of Martaban. Hindostan is watered in the north-east by the Ganges, which rises in the southern slope of the Himalaya Mountains, and after a course of about 1,000 miles, falls into the Bay of Bengal; this river is navigable to about half its distance from its mouth, that is, up to the point where it receives the waters of the Jumna. At Calcutta, where it falls into the sea, it forms a vast delta, called the Sunderbunds, and the navigable branch for large vessels is here called the Hooghly. Near the mouth, this river receives the waters of the River Sanpoo, or Brahmapootra, which rises in an opposite direction. Hindostan, again, is watered in the north-west by the Indus, a river which gives its name to all India, and which, rising also in the Himalaya Mountains, but on the northern side, at an elevation of about 15,000 feet, passes round its western extremity, and then runs a south-westerly course of about 1,950 miles, falling into the Arabian Sea by a delta near Tattah. About 350 miles from its mouth, this river receives the waters of *five rivers*, the Jelam, the Chenab, the Ravee, the Beas, and the Sutlej; hence the name of the country is the Punjab (that is, the *five rivers*). This river is navigable for large steamers at the distance just mentioned, and for smaller vessels about 350 miles higher. The Tigris and Euphrates, which rise in Armenia, and flow through the plains of Mesopotamia (the one after a course of nearly 800 miles, and the other after a course of about 900 miles), unite in the river called Shat-el-Arab, and fall into the Persian Gulf at Basra or Basora. In Asia Minor flows the Kizil-Irmak (the ancient *Halys*), through a course of about 400 miles, and falls into the Black Sea. The Caspian Sea receives the waters of the River Kur, after a course of about 500 miles. The sea of Aral receives the waters of the Amoo-Daria or Jihon (the ancient *Oxus*), after a course of about 880 miles; and of the Syr-Daria (the ancient *Jaxartes*), after a course of more than 720 miles. Such are the most striking physical peculiarities of the great continent of Asia.

We append to this lesson a map of India, showing the peninsulas of Hindostan and Further India or India beyond the



Ganges, which includes Burmah, Siam, Malacca, Cochin China, etc. The position of the three chief peaks of the Himalayas are indicated in this map.

SUMMARY OF PENINSULAS, ISTHUSES, CAPES, LAKES, MOUNTAINS, AND RIVERS OF ASIA.

PENINSULAS.	LAKES.
Asia Minor, in Turkey.	Caspian Sea.
Arabia, E. of Red Sea.	Sea of Aral, Turkestan.
India, S.E. of the Indus.	Lake Baikal, S. of Russia.
Malacca, or Malay Peninsula, S. of Siam.	Balkash, S. of Russia.
Corea, E. of Yellow Sea.	Tengri-Nor, Chinese Tibet.
Kamtschatka, E. of Siberia.	Bakhtegan, Persia.
	Dead Sea, Palestine.
ISTHUSES.	Sir-i-kol, Bolor-Tugh Mountains.
Suez, N. of Red Sea.	
Kraw, N. of Malay Peninsula.	
CAPES.	MOUNTAINS.
Baba, Asia Minor.	Bolor-Tugh Mountains, Central Asia.
Ras-al-Had, S.E. of Arabia.	Thian-Shan Mountains, Independent and Chinese Tartary.
Comorin, S. of India.	Ala-Tau Range, Southern Russia in Asia.
Dondrah Head, S. of Ceylon.	Altai Mountains, between Russia in Asia and Mongolia.
Negrais, S.W. of Pegu.	Sayansk Mountains, E. of Altai Mountains.
Romania, S. of Malay Peninsula.	Yablouoi Mountains, in Eastern Russia in Asia.
Camboja, S. of Anam.	Stanovoi Mountains, in Eastern Russia in Asia.
King, E. of Japan (Nippon I.)	
Lopatka, S. of Kamtschatka.	
East Cape, E. of Siberia.	
Severo Vostochnoi, or North-East Cape, N. of Siberia.	

Aldan Mountains, in Eastern Russia in Asia and Kamtschatka.	Zagros Mountains, or Mountains of Kurdistan, in S.W. of Persia.
Orulgan Mountains, E. of the Lena.	Mountains of Armenia, in N.E. of Turkey in Asia.
Baikal Mountains, W. of Lake Baikal.	Taurus and Anti-Taurus Ranges, in Asia Minor.
Kuen-Lun Mountains, between Chinese Tartary and Tibet.	Lebanon Mountains, in Syria and Palestine.
Pe-ling Range, in China (Central).	
Iu-shan Mountains, Mongolia.	
Khin-gan Mountains, Mongolia.	
Yun-ling Range, between China and Tibet.	
Nan-ling Range, in S. of China.	
Himalaya Mountains, N.E. frontier of Hindostan.	
Karakorum Mountains, Tibet.	
Mountains of Aracan, Burmah.	
Vindhya Mountains, Central Hindostan.	
Eastern and Western Ghauts, Peninsula of Hindostan (coast).	
Hindoo-Koosh Mountains, between Cashmere (Hindostan) and Afghanistan.	
Suliman Mountains, W. frontier of Hindostan.	
Paropamisus Mountains, N. of Persia.	
Elburz Range, N. of Persia.	

RIVERS.

Oti, Arctic Ocean.
Yenisei, Arctic Ocean.
Lena, Arctic Ocean.
Amour, Sea of Okhotsk.
Hoang-ho, Yellow Sea.
Yang-tze-kiang, Yellow Sea.
Choo-kiang, China Sea.
Ma-kiang, China Sea.
Meinam, Gulf of Siam.
Salween, Gulf of Martaban.
Irrawaddy, Gulf of Martaban.
Ganges, Bay of Bengal.
Indus, Indian Ocean.
Euphrates, } Shat-el-Arab, Persian Gulf.
Tigris, }
Orontes, Mediterranean Sea.
Kizil-Irmak, Mediterranean Sea.
Kur, Caspian Sea.
Amoo-Daria, Sea of Aral.
Syr-Daria, Sea of Aral.

LESSONS IN CHEMISTRY.—XXI.

METALS PROPER—continued.

CADMIUM.

SYMBOL, Cd—COMBINING WEIGHT, 112—SPECIFIC GRAVITY, 8.7.

At the commencement of the distillation of zinc, a brown smoke is often seen to issue from the crucible; this is the oxide of cadmium. The metal is rare. It resembles tin in appearance, and is so soft as to leave a mark upon paper. It melts at 315° Cent., and is volatile. Though generally found associated with zinc, it is easily separated from that metal by sulphuretted hydrogen, which precipitates from an acid solution the beautiful yellow sulphide of cadmium, which is used as a paint. The iodide of cadmium is used for iodising collodion for the use of the photographer.

COBALT.

SYMBOL, Co—COMBINING WEIGHT, 58.7—SPECIFIC GRAVITY, 8.5.

This metal is found associated with arsenic, nickel, manganese, iron, and copper, in ores more or less complicated. It is very difficult of extraction. It is found to be of a light-red colour, requiring a high temperature for its fusion. It possesses great tenacity, and exhibits magnetic properties. It is readily oxidised by nitric acid, and even by exposure to the air. It owes its commercial value to the brilliant colours which the salts of cobalt possess. It forms two oxides, namely, the protoxide (CoO), and the sesquioxide (Co₂O₃). The former is soluble in acid. The concentrated solution is of a beautiful blue, but when diluted, pink. This oxide will also combine with bases. With the hydrate of potash it forms a blue compound; with magnesium nitrate, a pink. Thénard's blue is its combination with alumina; and with the oxide of tin is formed Rinman's green. However, cobalt chiefly finds its way into commerce as smalt, which is blue glass coloured by this oxide. It is chiefly manufactured in Saxony. The ore which, besides cobalt, contains several metals in combination with sulphur and arsenic, is roasted sufficiently to cause the cobalt to become oxide. This is effected at a temperature too low to disturb the other combinations in the ore. Four parts of this roasted ore, with ten of quartz and four of potassium carbonate, are slowly melted in a furnace. The cobaltic oxide combines with the fused silicate of potash, and a blue glass is formed. The other constituents of the ore fall to the bottom of the crucible, and make that brittle, metallic mass, called *speiss*, from which nickel is extracted. The blue glass is poured out into cold water, by which it splits into fragments, which are afterwards ground between granite stones under water. The water is allowed to flow out, as the grinding proceeds, into depositing vessels, each being filled by the overflow of the one above it. It will be evident that the finest powder will be found in that vessel furthest from the mill. Smalt is used in the manufacture of paper-hangings, and to some extent by laundresses, to correct

and neutralise the yellow which tinges linen. The salts of cobalt are of little other interest. When crystallised they are red; when anhydrous, blue. Their solutions, when concentrated, are blue, and on being diluted, pass through red to pink. When a cold red solution is heated, it becomes blue again.

The presence of cobalt is easily detected by the intense blue it imparts to a bead of borax in the blow-pipe flame. A solution of its salts with potash becomes blue, and by an excess of the alkali, pink. Ammonia has the same effect, but the precipitate is readily dissolved in an excess of the liquid.

NICKEL.

SYMBOL, Ni—COMBINING WEIGHT, 58.7—SPECIFIC GRAVITY, 8.5.

Nickel is a white, silver-like metal; hard, yet ductile. Its magnetic properties are more marked than those of cobalt, to which metal it presents a very remarkable analogy. Nickel is extracted either from the *speiss* mentioned above, or from the ore *kupfernickel*, in which it is combined with arsenic. It is chiefly of value on account of its property of whitening brass,

thus producing *pack-fong* or *German silver*. Like cobalt, it forms two oxides: NiO, the protoxide, the salts of which are green, and when anhydrous, yellow; and Ni₂O₃, the sesquioxide, of which no salts are known. The hydrated protoxide is thrown down as an apple-green powder, when to any of the salts of nickel caustic potash is added. Ammonia has the same effect, but when added in excess dissolves the precipitate, rendering the solution blue. With sulphuretted hydrogen nickel behaves as cobalt. A bead of borax, touched with nickel, becomes a reddish yellow glass, which pales as it cools. In the reducing flame, greyish particles of the reduced metal are disseminated through the bead. *Kupfernickel*,

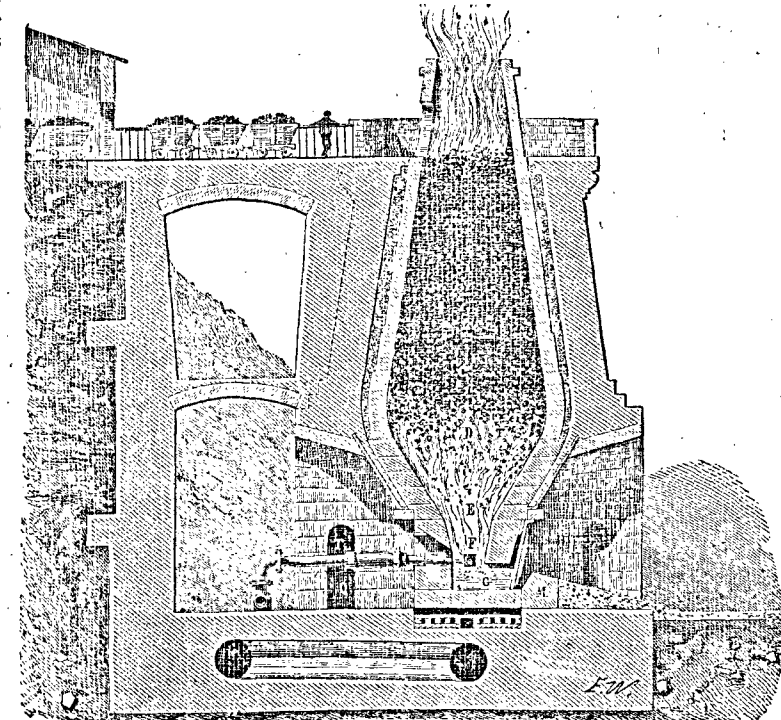


FIG. 50.—SECTION OF A BLAST FURNACE.

the ore from which nickel is usually obtained, is found principally in Saxony, and, in small quantities, in Cornwall.

MANGANESE.

SYMBOL, Mn—COMBINING WEIGHT, 55—SPECIFIC GRAVITY, 8.0.

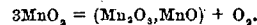
The metal itself is reduced from its oxide by charcoal at a very high temperature. It is of a greyish colour, feebly magnetic, hard enough to scratch steel. It soon crumbles to a brown powder in the air, and has the power to decompose water at ordinary temperatures; hence it has no commercial value, save that it is useful as an alloy with iron. A small percentage of manganese renders that metal both harder and more elastic.

Manganous Oxide (MnO).—By heating the carbonate, the carbonic acid gas is driven off, and this oxide remains as a green powder. It is a very powerful base, and rapidly combines with oxygen, forming a brown powder. It makes with mineral acids well-marked salts, which give pink solutions, from which an alkali will throw it down again, as a white hydrate, which becomes brown on exposure to the air.

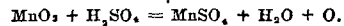
The *Sesquioxide* (Mn₂O₃) has been noticed as capable of forming an alum. It appears in nature as *braunite*. Its salts are

unstable. When their solutions are boiled, the corresponding manganoous salt is formed.

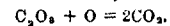
Binoxide, Deuteroxide, or Peroxide (MnO_2), is the *pyrolusite* of the mineralogist, the "manganese" of commerce. It is used in the laboratory in the preparation of oxygen and chlorine. When heated, it gives off one-third of its oxygen, and becomes the *red oxide*—



When heated with strong sulphuric acid, half its oxygen comes off, thus—



The commercial value of this black oxide depends upon the proportion of chlorine which it will liberate from hydrochloric acid, and this again is dependent on the quantity of oxygen present, which is over and above that requisite to make the ore a protoxide, for pyrolusite and psilomelane are never pure deuteroxide. This is estimated on the principle that black oxide of manganese is decomposed in the presence of free sulphuric and oxalic acids. The oxygen which is liberated as the salt becomes a protosulphate (MnO, SO_4), attacks the oxalic acid, causing it to become carbonic acid, thus—



By allowing this CO_2 to pass through a weighed potash tube, its quantity may be estimated, and therefore that of the binoxide in the sample of ore.

Manganic (H_2MnO_4) and *Pernanganic Acid* ($\text{H}_2\text{Mn}_2\text{O}_8$).—When equal weights of caustic potash and manganese peroxide in fine powder are fused together, a bright-green mass is formed; this is potassium manganate. It forms a dark-green solution, which, when diluted, slowly passes through purple to a claret colour, and hydrated manganic dioxide is found to be deposited. The cause of this is that the manganate absorbed oxygen, becoming a permanganate. Owing to these changes of colour, it has acquired the name of *mineral chameleon*. A solution of potassium permanganate readily oxidises organic matter; hence it is used as a disinfecting agent, as *Condy's Fluid*. The presence of manganese is easily detected by "Crum's test." Add to the suspected body a little dilute nitric acid, and a little peroxide of lead; if any manganese be present, the red colour of permanganic acid will be produced. A bead of borax becomes violet if manganese be present in the oxidising flame of the blow-pipe, but the colour is lost in the reducing flame. With carbonate of soda, the salts of this metal give a bluish-green opaque bead in the blow-pipe flame.

IRON.

SYMBOL, Fe.—COMBINING WEIGHT, 56.—SPECIFIC GRAVITY, 7.8.

This, the most important of all the metals, is never found native, except in "meteoric stones." Its ores are plentiful, and widely diversified. The chief are—

Magnetic Iron Ore, Loadstone ($\text{Fe}_2\text{O}_3, \text{FeO}$).—It occurs in the Swedish mountains, and in North America. Most of the celebrated Swedish iron is from this ore. It is found in masses in the primary rocks; and therefore, coal being absent, wood is used in its reduction, which fact contributes to the fine quality of the metal it yields. The *Iron Sand*, found in India and New Zealand, belongs to this class of ore. It is the only ore of iron which occurs in any quantity capable of magnetism, and is magnetised by the influence of the earth's magnetism in its original state; hence the properties of the loadstone.

Specular Iron Ore (Fe_2O_3).—This is found in Elba, Russia, and Sweden, and gives iron of a fine quality.

Red Hematite is another form of the peroxide. It is sometimes found massive, but generally as fibrous, crystallised nodules, which, from their colour and smooth mammillary surface, have obtained for this ore the name of the "kidney ore." It is seldom smelted alone, but generally with the clay ore.

Brown Hematite is another variety of the peroxide, which is found in later deposits known as *pea-iron ore*.

Spathic Iron Ore is a carbonate of the metal, and so also is the great source of English iron—

The Clay Iron Ore.—This is found in bands in the coal deposits. It contains about 30 per cent. of the metal, the rest of its bulk being clay, lime, and magnesia.

The Bog Iron Ore contains phosphate of iron, and, as its name indicates, is found in alluvial tracts.

Iron Pyrites (FeS_2), though very abundant, is never worked for iron, but for sulphur.

REDUCTION OF IRON FROM THE CLAY IRON ORE.—We may conveniently divide this operation into four stages:—

1. *Roasting*.—The ore, mixed with coal, is piled in large heaps, and a fire is kindled to the windward, which gradually extends through the mass. This heat expels all moisture and carbonic acid gas. The "calcined ore" is left in a porous state, containing iron as an oxide. This process requires months for its completion.

2. *Smelting*.—The blast furnace is a structure, as in Fig. 50, about fifty feet high. It is built of solid masonry, and lined with fire-bricks. The lower part of the cone contracts into the *crucible*, E F. Below the tuyeres, or blast-pipes, the furnace terminates in the *hearth* G, where the melted metal collects previously to being drawn off; M is the *tymp stone*, over which the slag runs down, and thus leaves the furnace; T and R are the *tuyeres*. At the lowest point of the furnace is the *tap-hole* by which the metal is drawn off. The calcined ore contains chiefly *oxide of iron, silica, and clay*. No amount of heat will separate these infusible bodies from the iron; hence it is necessary to add lime in order that a fusible *slag* may be found. Thus the furnace is charged with alternate layers of *coal, limestone, and ore*. The air which forms the blast is driven by fans, and caused to pass through heated tubes, so that when it issues from the tuyeres its temperature is about 350° Cent. If cold air were used, it would seriously detract from the heat of the furnace, for as much as *six tons* of air pass through in an hour. The oxygen of the blast at once combines with the carbon of the fuel in that part of the furnace called the "*boshes*," D, and becomes carbonic acid gas; ascending a little higher in the furnace this gas—as in an ordinary fire—takes an atom of carbon, becoming carbonic oxide, which, mixed with nitrogen and carburetted hydrogen, rises through the furnace. In the presence of these gases, the iron in the ore becomes reduced, but the temperature at that part of the furnace is not sufficient to melt the iron, or make the silica and lime fuse together. But when the charge sinks down into the crucible, the fusion of the slag is determined, and the iron, which is in a finely-divided state, combines with the carbon, and fuses into the *carbide of iron*, known as *cast-iron*. This falls to the bottom of the crucible, and the slag, which is five or six times the bulk of the iron, swims upon it, and preserves it from the action of the air of the blasts. As the slag accumulates, it rises to the level of the tymp stone, over which it flows to N, where it is received into an iron box, and is thus removed. The iron is drawn from the furnace once in twelve hours, and run into sand-moulds, and finds its way to the market as *pig-iron*. A blast-furnace continues in action for six or eight years uninterruptedly.

LESSONS IN GERMAN.—XL

SECT. LXXXI.—VARIOUS IDIOMATIC PHRASES (continued).

Nicht, or nicht dafür können, signifies "not to be in fault, or to blame," as:—Ich kann nichts dafür, it is not my fault, or I cannot help it (literally, I cannot, or can nothing therefore). Er kann nichts dafür, daß er so arm ist, he cannot help it—that is, he is not to blame—that he is so poor. So also interrogatively, as:—Kann die Welt etwas dafür, daß sich ein großer Geist in ein schlechtes Kleid verkleidet? (Rabener)—is the world to blame, that a great soul conceals itself in a plain dress? that is, Die Welt kann nichts dafür.

VOCABULARY.

Angeben, to give, specify.	Kern, m. kernel.	Unwürdigkeit, f. unworthiness, indignity.
Anstrengung, f. exertion, effort, labour.	Kutschmann, m. coachman.	Verderben, to spoil, corrupt, destroy.
Bereit, ready.	Ordnung, f. order, regulation.	Verzicht (auf etwas), to resign, i.e., as a privilege or a claim on anything.
Beufen, m. calling, vocation.	Schale, f. shell.	Vorgehen, to go before, go too fast.
Beurtheilen, to quiet.	Schwächling, m. weakling, weakly person.	Sagen, m. carriage.
Bestimmen, to fix, determine.	Teller, m. plate.	Wiesheit, f. wisdom.
Desfür, therefore, for it.	Umstellen, to enclose, surround.	Wesen, n. existence, being.
Dank, m. thanks, acknowledgment.	Umverfren, to upset.	Zerbrechen, to break off, omit, fail.
Erretten, to save, rescue, deliver.	Unordentlich, disorderly, irregular, confused.	
Furcht, f. fear, dread.	Unterlassen, to leave off, omit, fail.	

RÉSUMÉ OF EXAMPLES.

Ich kann nichts dafür, daß ich mein Geld verloren habe.	It is not my fault that I have lost my money.
Diese Uhr geht sehr (or, zu schnell) und jene geht nach (or, zu langsam).	This watch goes too fast, and that (one) goes too slow.
Hat man mein Zimmer in Ordnung gebracht?	Has my room been put in order?
In der Reihe seiner Schmeichler hat er keinen wahren Freund.	In the ranks of his flatterers he has not a true friend.
Es giebt Viele, die glauben, daß in den meisten Fällen das Glück oder Unglück eines Menschen vom Zufall abhängt.	There are many who believe that, in (the) most cases, the fortune or misfortune of a man depends on chance.
Leben Sie wohl, mein Herr, und empfehle Sie mich gültig Ihrer Frau Gemahlin.	Farewell, Sir, and please remember me kindly to your lady.

EXERCISE 156.

1. Sie können nichts dafür, daß Sie so unglücklich sind. 2. Er konnte nichts dafür, daß er dieses Glas zerbrach. 3. Ich kann nichts dafür geben, als meinen Dank. 4. Die Gründe dafür werde ich angeben, wenn es verlangt werden sollte. 5. Können Sie mir sagen (Sect. LXXXII. 1), wie viel Uhr (Sect. XXIV. 9) es ist? 6. Nein, denn meine Uhr ist stehen geblieben. 7. Steht Ihre Uhr schon lange? 8. Ja, beinahe eine Stunde. 9. Meine Uhr geht zu schnell, sie geht beinahe eine halbe Stunde vor. 10. Die Uhr meines Bräutens geht fünf Minuten vor. 11. Leben Sie wohl, und vergessen Sie nicht, mich bald wieder zu besuchen. 12. Leben Sie wohl, mein Herr! 13. Wann wollen wir zusammen Herrn N. besuchen? 14. Es hängt ganz von Ihnen ab (Sect. LXXX. 1) welche Zeit Sie tags bestimmen wollen, ich bin zu jeder Zeit bereit, mitzugehen. 15. Es hängt von Ihnen ab, diese Familie zu erretten oder zu verderben. 16. Der Nachbar arbeitet in seinem Garten und sucht denselben in Ordnung zu bringen. 17. Bei aller Anstrengung bringt er diese Sache nicht in Ordnung. 18. Er suchte mich in die Reihe seiner Kameraden zu bringen. 19. Es fällt schwer (Sect. XLV. 2), einen unentertlichen Menschen an Ordnung zu gewöhnen. 20. Nach vieler Mühe hat er die Rechnung in Ordnung gebracht. 21. Wer an dem Fusse eines steilen Berges stehen bleibt, und aus Furcht vor Anstrengung denselben zu erklimmen unterläßt, und lieber auf die schöne Aussicht verzichtet, der zeigt damit an, daß er ein Schwächling und eines solchen Genusses unwürdig ist,—und wer aus eigener Schuld in der Mitte seiner geistigen Ausbildung stehen bleibt, und den süßen Reiz der Weisheit entbehren will, weil eine rauhe und harte Schale denselben umhüllt, der zeigt ebenfalls nicht nur seine Unwürdigkeit, denselben zu genießen, an sondern auch, wie wenig er den Beruf und die Pflicht des Menschen, als eines geistigen Wesens, erkannt hat.

EXERCISE 157.

1. It is not my fault that you have had the mishap. 2. You are not to blame that the servant has broken the plate. 3. He could not give me anything for it, except his thanks. 4. He could not help it, he only spoke the truth. 5. Is the coachman to blame that the carriage was upset? 6. No, he is not to be blamed, for the horses could not be quieted. 7. Can you tell me what time it is? 8. No, my watch goes too slow. 9. To fix the hour of my departure depends upon my parents. 10. Farewell, Madam; please do not forget to remember me to your parents. 11. It depends upon you what time you will fix to visit your friends; I shall always be ready to accompany you. 12. Fortune and misfortune, life and death, poverty and riches, all depend on the will of God.

SECTION LXXXII.—VARIOUS IDIOMATIC PHRASES (continued).

Sich verstehen (to understand one's self), with auf, signifies "to be a judge of, to be skilled in;" as:—Er versteht sich auf Alles, he is skilled in everything. Er versteht sich (literally, it understands itself—that is, it is understood, is self-evident) answers to our phrase "of course," or "as a matter of course;" as:—Es versteht sich, or es versteht sich von selbst, daß ich meinen Eltern gehorchen muß, of course, or as a matter of course, I must obey my parents. The word natürlich, naturally, is often used in the same manner; as:—Natürlich muß es so sein, of course it must be so.

1. Sagen answers to the English "say" or "tell;" to tell or narrate, however, is often expressed in German by erzählen; as:—Was sagte er? what did he say? Was hat er Ihnen gesagt? what has he told, or said to you? Der alte Mann erzählte eine interessante

Geschichte, the old sailor told, or related a moving (affecting) story.

2. *Fert* is often expressed in English by "gone, off," etc.: as:—Ist er schon lange fort? has he already been gone long?

3. *Es sei denn, daß*—unless, except, etc.: as:—Der Mensch kann nicht wahrhaft glücklich sein, es sei denn, daß er tugendhaft sei, man cannot be truly happy unless he be virtuous. *Wahrlich, wahrlich*, ich sage dir: Es sei denn, daß jemand von Neuem geboren werde, kann er das Reich Gottes nicht sehen. Verily, verily, I say unto thee, Except a man be born again, he cannot see the kingdom of God.

VOCABULARY.

Anwalt, m. attorney, defender.	Sin'kommen, to come, get to.	Scherz, m. jest, sport.
Bahnen, to open (as a path), facilitate.	Park, m. park.	Stören, to trouble, disturb.
Ende, n. end.	Pflanze, f. plant, vegetable.	Türkisch, Turkish.
Fert'gehen, to go away.	Schein, m. shine, light.	Verschwendlich, prodigal, lavish, profuse.

RÉSUMÉ OF EXAMPLES.

Wissen Sie, wie weit Sie in der Sache zu gehen haben? Do you know how far you have to go in the matter? (how far you are at liberty to go.) Ginen wie langen (§ 120. 4) Spazierritt haben Sie gemacht? How long a (pleasure) ride have you taken? Es versteht sich von selbst, daß ein fauler Schüler keine Fortschritte machen kann. It is self-evident that a lazy scholar can make no progress. Dieser Italiener versteht sich auf Musik. This Italian is a judge of music. Herr M. ist heute Morgen fort nach Nord-Amerika. Mr. M. left (is off) this morning for North America. So weit er auch von hier wehnt, und so lange ich auch zu gehen habe, so besuche ich ihn dennoch alle Tage. However far he resides from here, and however great a distance I have to walk, I nevertheless visit him every day. Wohin eilen sie so schnell? Whither are you hastening so rapidly? Ich gehe zu dem Zahnärzte. I am going to the dentist. Die Sache sei nun, wie sie wolle, ich werde ihm nicht verzeihen, es sei denn, daß er mich um Entschuldigung bitte. Well, be it (the thing) as it may, I shall not forgive him unless he ask my pardon.

EXERCISE 158.

1. Der Dieb ist seines Verbrechens überführt worden, und es versteht sich von selbst, daß er bestraft werden wird. 2. Der Vater ist seit heut Morgen fort und bis jetzt noch nicht wieder zurückgekehrt. 3. Das Buch ist fort, und keiner dieser Schüler will (§ 83. 8, Remark) wissen, wo es hin gekommen ist. 4. Meine Messen sind fortgegangen, ohne zu sagen, wohin sie gingen. 5. Unser Obst ist alle. (Sect. XL. 3). 6. Auch nach so vielen Geld mir alle, wenn man verschwendlich ist. 7. Der türkische Kaiser Soliman II. sagte kurz vor seinem Tode: „Meine Kräfte sind zu Ende, nicht aber mein Muth.“ 8. Wie weit gehen Sie spazieren? 9. Ich gehe, bis ich müde werde, gewöhnlich bis an (Sect. LVII., Note) ten Part. 10. Mein Freund weiß recht gut, wie weit er in dieser Sache zu gehen hat. 11. Man muß selbst im Scherze wissen, wie weit man zu gehen hat; denn auch im Scherze kann man beleidigen. 12. Wo gehen Sie hin? 13. Ich gehe zu meinem Anwalt. 14. Wie weit haben Sie zu gehen? 15. Wie an das Ende der Stadt. 16. Wie lange haben Sie zu gehen? 17. Ueber eine Stunde. 18. Ginen wie weiten Spaziergang haben Sie gemacht? 19. Ich bin bis in der Nähe des Flusses gewesen. 20. Ginen wie langen Spaziergang haben Sie gemacht? 21. Ich bin über eine halbe Stunde spazieren gegangen. 22. Wie lange sind Sie aus dem Hause gewesen? 23. Ich war dreierlei Stunden aus dem Hause. 24. Waren Sie weit von demselben entfernt? 25. Ich bin beinahe eine halbe Stunde weit von demselben entfernt gewesen. 26. Ich hoffe auch wiederkommen, es sei nun in tiefer, oder sei es in jener Welt. 27. Der Gefangene meinte, es sei nun lange genug, daß er den warmen Schein der Sonne und die frische Luft habe entbehren müssen. 28. Ich kann morgen nicht zu ihr kommen, es sei denn, daß mein Bruder bis dahin wieder ganz gesund würde. 29. Ich kann heute unmöglich diesen Brief befehlen, es sei denn, daß ich diesen Nachmittag weniger beschäftigt werde. 30. Es wird Niemand in die Stadt eingelassen, es sei denn, daß er einen Paß habe.

EXERCISE 159.

1. Tell me if that is your own horse? 2. That farmer told me many things about agriculture. 3. I shall not go out to-day unless necessity compels me. 4. You will not enter the king-

dom of heaven unless you acknowledge the blessings of God. 5. My brother went off yesterday, and we have heard nothing of him. 6. It is self-evident that without nourishment man, animals, and plants cannot exist. 7. My knife is gone, and none of the children know where it is. 8. Our money is all gone. 9. I know very well how far I have to go in this matter. 10. Where do you go to? 11. I am going to my brother. 12. How far have you to go? 13. Just to the park. 14. What distance have you to go? 15. About three quarters of a mile. 16. He believed the time had now arrived to open his own path through life.

KEY TO EXERCISES IN LESSONS IN GERMAN.

EXERCISE 115 (Vol. II, page 246).

1. Ist Ihr Bruder so versüßigt als Ihr Onkel? 2. Er ist nicht so versüßigt, als mein Onkel. 3. Nimm, weiter mehr noch weniger als die Notz erfordert. 4. Obgleich er ein schönes Landgut besitzt, so will ich dennoch einen Theil des meinsten an ihn abtreten. 5. Sie thaten nichts, als sich über ihr letztes Unglück beklagen. 6. Ich sah Niemand in dem Saal, als den blinden Pfeifer. 7. Je länger er bei ihm blieb, desto ungeliebter wurde er. 8. Den meisteilen wird Ihr Freund von hier abreisen? 9. Seine Abreise ist auf den vierzehnten nächsten Monats festgesetzt. 10. Wir wollen diesen Weg gehen, um die Landschaft in der Nähe zu sehen. 11. Nichts als Freischießzeit war in der ganzen Familie. 12. Nur ein Wunsch blieb ihm übrig. 13. Niemand ist unserer Güte so würdig, als der Freund meines Bruders.

RECREATIVE NATURAL HISTORY.

THE BAT.

OFTEN in the summer twilight you may have seen a dark-looking object, apparently about the size of a sparrow, flitting hither and thither in the most erratic fashion. Such a strange-looking creature did it appear that one might have fancied it was some old-world inhabitant of strange form, like those figured in books on geology, which had wakened up after a sleep of ages to have a look round once more on the present state of things. It was a bat. Upon questioning the rustic wise-acre concerning it, you were probably told that it was neither bird nor beast, but a sort of cross between them, being bird-like in possessing the power of flight, and also like many a four-footed beast in having a fur, and jaws provided with teeth. Here, however, his fund of information was exhausted. He might be thoroughly acquainted with the habits and haunts of birds, also able to imitate their peculiar notes, but concerning the bat he knew next to nothing.

And indeed, the peculiar habits of the bat preclude that amount of observation which has been given to most other animals. Hidden entirely from us during the winter months, and only seen in warmer weather in the dusky evenings, it is only natural that our store of facts concerning it should be a small one. It was a puzzle to the ancients, for they did not know exactly where to place it in their classifications of the animal kingdom. And, apparently in some doubt, Pliny describes it neither under the head of beast nor bird, but gives it a small chapter to itself, wherein he observes:—"Among the winged animals, the only one that brings forth its young alive, is the bat; it is the only one, too, that has wings formed of a membrane. This is also the only winged creature that feeds its young with milk from the breast." No difficulty is experienced nowadays in giving the bat a precise place among the other members of the animal kingdom. Since it suckles its young, it belongs to the Mammalia, and bats of all sorts are included in the order of Chiroptera, or hand-winged animals. Why the order to which bats belong should be termed Chiroptera, or hand-winged, is pretty evident from a cursory examination of one of these curious creatures. When its arms and fingers are stretched out, a web-like membrane is seen to extend between each finger, and from arm to leg, and from leg to tail. Hence from the first finger to the tip of the tail on each side there is a membrane which acts as a wing, and as a most important portion of this wing-like structure is formed by the long bony fingers of each hand, the bat may very appropriately be termed hand-winged. The skeleton of the bat is slightly different from that of other Mammals, and this mainly arises from their different mode of progression. For example, there is the same difference between the breast-bone of a bat

and the breast-bone of a mammal which walks, as there is between the breast-bone of a flying bird and that of an ostrich. As we have pointed out in the paper on the ostrich family, its breast-bone is keel-less, while that of a flying bird has a keel or ridge projecting from it to form a firm base of attachment for the wing muscles. Similarly, the breast-bone of a bat has a projecting ridge, and is very unlike the breast-bone of a man, for example, which is a plane elongated plate of bone. The humerus is short and powerful. The shoulder-joint is universal in its nature, so that the action of the bat's wing is particularly free.

The bat flies for lengthened periods with ease. The Margined Fruit Bats of India will fly for thirty or forty miles away from their haunts, and return the same night, making up a distance of eighty miles. And when one reflects that in their search for guavas they pass over high hills and through winding passages to the very places where they grow, it is apparent that they possess a high order of instinct. This is also shown in other ways. Speaking of some captive bats, Mr. Bell says:—"One of them displayed, in its search for a means of exit, an ability which was quite extraordinary. It literally flew into every part of the room, and behind and under everything, even under a book case standing against a wall, although there was scarcely a space of three inches between it and the floor." When brought up in captivity, they will display a certain amount of affection for the person who tends them. Young African Fruit Bats, which have been born at the Zoological Gardens, have displayed their affection for their keeper by mounting upon his shoulder and even licking his face in the same way as a dog.

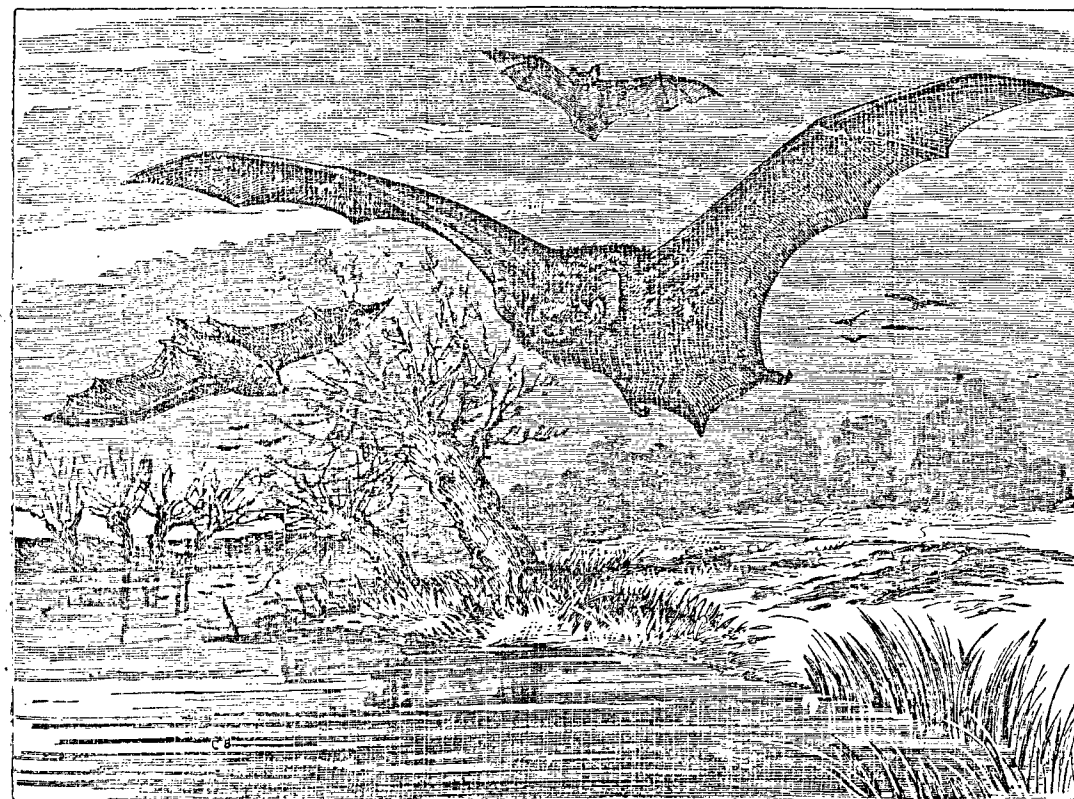
The bat is not blind as some have supposed. It can see quite well, and it would appear that its other senses are so well developed that, when it has been deprived of its sight, it would avoid objects which were in its way, and find out retreats that one would have thought were hidden from it in its sightless condition. We know how a human being, who has been blind for years, may, by the cultivation of his remaining senses, perform feats that would be impossible to a blindfolded individual possessing eye-sight, and the similar power of sightless perception possessed by the bat may have been acquired by the necessity there has been for it and its ancestors to constantly find their way about in the dark. Certainly the experiments of Spallanzani, de Jurine and others, who experimented on some bats which had lost their eyesight, go to prove that these creatures can find their way about without their eyes as marvellously as a man who has been born blind. Some knowledge of this ability of theirs may have given rise to the misleading proverbial expression:—"As blind as a bat." Some bats are fruit eaters, and others live on insects. The bats found in this country are insectivorous. During the winter, when food is scarce, they have a long sleep, and in this hibernating condition they may occasionally be seen suspended from the roofs of dark caverns, deserted attics, belfries, &c., holding on by the claws of their hind feet, with their heads downwards.

This winter sleep is a curious phenomenon. One has a difficulty in seeing how life can be sustained for months during the coldest part of the year, without the sleeping animal receiving any food. The eight to ten hours' sleep which man gets, once every twenty-four hours, will bear no comparison with the long periods that hibernating animals, like the bat, take up, because a person would experience very little inconvenience if compelled, in the waking state, to go without food for the same length of time as he slept. If, however, a hibernating animal were compelled to go without food, in the waking state, for only a part of the time it takes up in sleeping during the winter months, it would die. The hibernating condition must therefore be widely different from the waking state: there must be much less waste of force, and all the vital functions must be at their lowest ebb. The temperature of the body, which is a mark of the silent combustion going on, will be lower than at other times, and the flow of the blood through the vessels will be much slower. This has been proved experimentally. Mr. Cornish found, upon applying a thermometer to a torpid bat, that it stood at 36°, only 4° above the freezing point of water, and the heart beat just sixty times per minute. Upon wakening it up, the beats of the heart increased to one hundred per minute, and the heat of the body rose two degrees. It is

therefore apparent, that during hibernation, the vital processes proceed very slowly, and that there is a minimum of waste. It is a matter of curious interest that Indian Fakirs, under the influence of opiates or of Indian hemp, have remained in a state of trance for six weeks. This is perhaps the nearest approach to hibernation in man. Bats are capable of retaining life for a long time in the torpid state. It is said that a torpid bat was found in a family vault, which was opened in Norwich in 1806, after being closed for 32 years. Hibernation corresponds to sleep in its tendency to periodical return, and in the bat it is not so deep as in certain other animals, for, on the occurrence of very fine warm days in winter, it flies forth in quest of insects. Many kinds of bat live in the British Islands. The most common one, found in nearly every part of the country, is the

the day there sleeping in bat fashion—head downwards, and clinging with the claws of the hind feet to some object—and then setting forth at night moth hunting. The colour of the fur appears to vary with the age of the individual, as is the case with many other animals; it is usually of a reddish or greyish-brown tint, the hairs being blackish at the base.

The Great Bat, or Noctule (*Vesperugo noctula*) which was first noticed in this country by White, of Selborne fame, is not so common as the Pipistrelle. It is a sociable bat, flocks of them repairing to the same hiding place, generally the hollow of some old oak or other tree in preference to a building. It is a high flier, and in its journeyings through the air generally proceeds in straight lines, emitting all the while sharp and shrill cries. It feeds on insects, and has a special liking for



THE PIPISTRELLE, OR COMMON BAT.

Pipistrelle, or Flittermouse (*Vesperugo pipistrellus*). Its winter sleep is a comparatively short one, as it does not retire until winter has well set in, and it is on the wing again as early as the middle of March. It lives on gnats, midges, and other small insects. Its ears are about two-thirds the length of the head, with a tragus or cartilaginous eminence at the external entrance of the ear, not quite half as long as that organ. Its body is a reddish-brown colour above and of a paler tint beneath. It can run, walk, and climb with considerable facility. It is not very particular as to where it resides, being at home in the crevices of old brick walls, under the roofs of houses, and in fact nearly in any ruinous place and position where it is not likely to be interfered with.

Another common British kind is the Long-eared Bat (*Plecotus auritus*), so called because of the abnormal length of the ears, which are nearly seven-eighths the length of the head and body, being usually a little over an inch and a half long. It takes its nightly wanderings in search of moths, which form its chief food; and, when on the wing, its shrill cries in the silence of the night, as it flits overhead, may be easily told from those of any other kind of bat. It resides principally in church towers and in the roofs of tiled houses in the country, passing

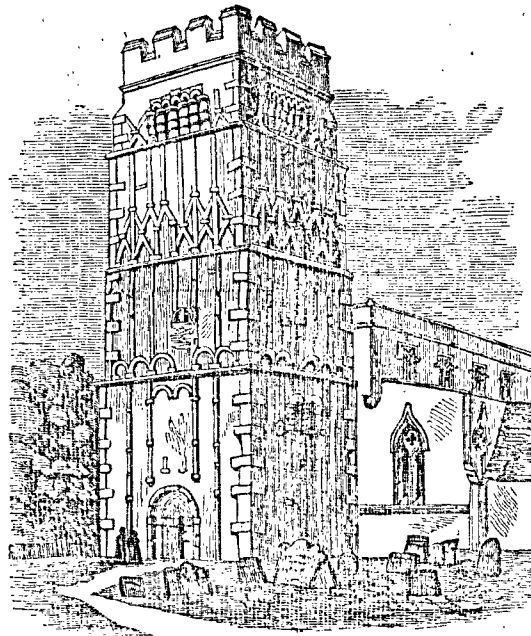
cockchafers. Its head and body are about three inches in length, and the expanded wings about fourteen inches across. The ears are shorter than the head, and each tragus is about one-third the length of an ear. The fur is reddish-brown.

The facial aspect of some bats is rendered very remarkable by the presence of what are termed nose-leaves. This is the case with the Horse-shoe bats, which chiefly inhabit warm countries. The Greater Horse-shoe Bat (*Rhinolophus ferrumequinum*), which is sometimes found in our southern counties, has a membranous appendage attached to the nose, roughly speaking, in the form of three leaves. It is the horse-shoe shape of the two lower leaves which gives rise to the name of this genus. The base of the third leaf rests in the concavity of the horse-shoe, and tapers to a point on a level with the forehead. The ears of the Greater Horse-shoe Bat are large, broad at the base, pointed at the top, and turned outwards. They are of the same colour as the nose-leaves, pale brown. Another bat of the same genus as the preceding is about half an inch shorter, and is known as the Lesser Horse-shoe Bat (*Rhinolophus hipposideros*). It is found in our islands, and was formerly looked upon upon as an under-grown Greater Horse-shoe bat. There are some slight differences between

from the original ground-plan arose, another and more characteristic design being adopted. The form of the *basilica* frequently gave place to that which was the accepted symbol of the Christian religion, and instead of the plain parallelogram, the figure of the cross gradually became used, in one or other of its variations. Nor did this involve a very great alteration of the custom previously in vogue. The *basilica* frequently had entrances at the side, and merely by the throwing out of these entrances to the right and to the left, the Christian symbol was at once developed. The plan was available, and probably sometimes adopted, with regard to buildings already in existence, as it made them suitably distinctive in character and removed them from heathen associations. But it also commended itself at once for future adoption; and from the early times of which we are speaking down to the present day, it has continued to prevail as one great characteristic of the architecture of the Christian Church.

We come, then, here to the second stage in its early history, when one or other of the forms known as the Latin and the Greek cross—whichever might be most convenient in planning a particular edifice—was usually employed in a building designed for Christian worship. We shall find these forms in the most elaborate structures of which Christian architecture can boast.

As time wore on, the exterior of these cruciform churches became adorned with a dome, a tower, or a steeple, at the point where the lines of the cross intersect each other. The dome, however, was the characteristic of the architecture of Eastern Europe, which acquired the name Byzantine from its having been carried to great perfection in Byzantium (or Constantinople), the capital of the Eastern Empire. The church of St. Sophia, which was built in its present form early in the sixth century, and converted into a mosque after the capture of Constantinople by the Turks, was and is the most perfect example of



SAXON TOWER AT EARL'S BARTON, NORTHAMPTONSHIRE.

itself between the sixth century and the twelfth, when it became well defined and generally adopted. Whilst it was attaining its full development, there arose those magnificent cathedrals, minsters, and abbeys, of which our own land, as well as France and

Germany, possesses so many noble examples. The wealth lavished on their construction, the grandeur of their design, with the patient skill bestowed on all parts of the workmanship, as well as its enduring character, are striking proofs of the spirit of reverential piety which existed in what is now considered a comparatively barbarous age.

The term Gothic, as applied to the architecture of the Middle Ages, was first used as one of reproach or contempt, synonymous with *barbarous*, by the architects who, in the sixteenth century, commenced a revival (known as the Renaissance) of the classical styles, and their adaptation to modern uses. But it has long lost this signification, a more discriminating criticism having produced a better

the Byzantine style. In this style we still find as a chief feature the Roman arch applied in a variety of ways, the dome itself being simply this arch, in a perfect form, used as the crowning work of the structure. Where it was used, the church itself generally took the form of the Greek cross, which was better calculated to support the weight of the cupola. On the other hand, in the architecture of the West, where the flat square tower, afterwards developed into the steeple, prevailed as the finishing-point, the original form of the Latin cross was retained, and this is therefore the general characteristic of the ground-plan of the churches of Western Europe.

The nations of the West gradually departed from the Romanesque style of architecture, and struck out for themselves a manner and style of their own, which, although it still contained some of the Romanesque features, was nevertheless different in character, and gradually became more and more so. In this way the great style known as the *Gothic* developed



NORMAN DOORWAY, HAILES CHURCH, NORFOLK.

appreciation of this grand mediæval style, and its peculiar fitness for the religious purposes for which it was chiefly designed.

We cannot here pause to trace its progress from its earlier elements, and in the different countries in which it made its way. We must take it up on its introduction into our own land, where it followed the rude and primitive *Saxon* and the more polished *Norman* styles. Each of these styles was in its character Romanesque, the arch of Roman shape being the chief feature in both. The Saxon churches were generally very humble in character, but scarcely any remains of them are now in existence. Among the few unquestioned relics of this age is the tower at Earl's Barton, Northamptonshire, of which we give a representation. Of the Norman stone edifices, however, very many beautiful relics are preserved, and by these we are made fully acquainted with both the interior and the exterior character of their buildings.

The Norman style may be dated from the Conquest in 1066, continuing till towards the close of the following century, and it is therefore sometimes called the twelfth century style. We have alluded to its Romanesque feature of the round arch, which in Norman churches was supported on short and stout pillars, and generally repeated from end to end of the building. A fine example exists in the interior of the abbey at Malvern, and others may be met in portions of our older cathedrals. The walls of the churches were thick and substantial, with small windows, and without much adornment, except in the doorways, which were elaborately ornamented. An example, from Hailes Church, Norfolk, is

given in our engraving, and in this the semi-circular arches and their zigzag mouldings, peculiarly characteristic of the Norman style, are well illustrated. The square flat tower crowning the edifice was also a not uncommon feature in the Norman period. Towards the close of the twelfth century a wide departure from the Norman style was introduced from the central provinces of France, where it is believed to have originated. It consisted chiefly in the substitution of a pointed arch for the old rounded form; and this style, now known as the Gothic, came so immediately into acceptance for church architecture, that in a few years after its introduction the Norman style had fallen almost entirely into disuse. The first period of Gothic architecture in this country is known as the *Early English*, and, as it lasted from about the year 1185 to 1280, it is generally known as the style of the thirteenth century. At first there was, as it were, a struggle for predominance between the round

and the pointed styles, and occasionally, in buildings of what is termed the Transition period, both arches were used in the same edifice. A fine example of this union is found in the rotunda of the Temple Church, in London, from which our illustration of the Gothic or pointed arch is taken. The Gothic arch, it will be seen, occupies the chief position in the structure. The Norman or Romanesque arch, still used, but declining, occupies only a subordinate position in the upper portion of the building.

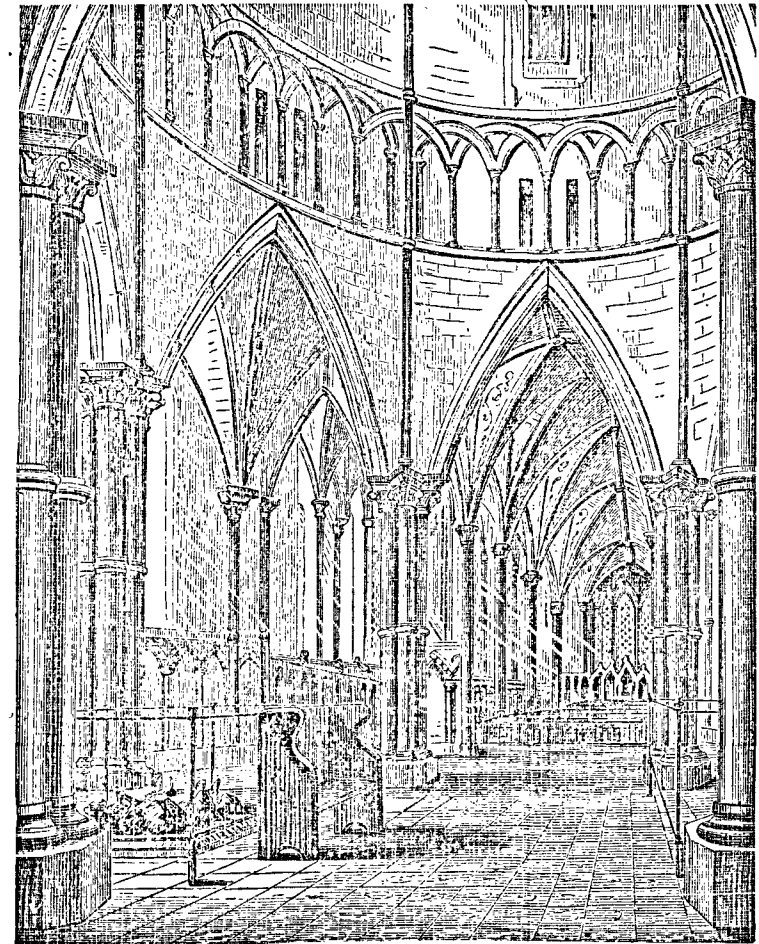
The pointed arch was so picturesque in effect, and gave such an entirely new and more suitable character to edifices for religious worship, that, as we have said, but a very little time elapsed before the Norman style was entirely superseded by

this earlier development of the Gothic. With the round arch, the short and heavy pillars on which it had rested now disappeared, and were substituted by tall and slender columns. The aisles were thrown up to a greater height; loftier and more impressive vistas were thus produced; the small and thick-set Norman windows gave place to others, long and narrow, and pointed like the Gothic arch itself; and the mouldings introduced for ornament took a more refined and graceful form.

The Early English form of Gothic architecture was succeeded in the thirteenth century by the *Decorated* style, which prevailed throughout the fourteenth century. In this, as the name implies, the ornamentation was more profuse, and it was also more graceful. It is, perhaps, the finest period of Gothic architecture in this country, as the style, while rich in beauty, had not become too florid, as it did at a later date. Hence

the term "pure Gothic" is sometimes applied to the architecture of this period.

The Decorated style of the fourteenth century was succeeded by the *Perpendicular* period, which endured through the fifteenth century and a portion of the sixteenth. The tracery of the doors and windows now consisted chiefly of perpendicular lines, the pointed arches of the doorways often being inserted in square compartments. The ornaments introduced in this period are more varied but less tasteful than in the Decorated style. But the fine open wooden roofs which are found in some of the Perpendicular churches, and the still more striking stone roofs of Henry VIII.'s Chapel at Westminster and King's College Chapel at Cambridge—both belonging to this period—must always challenge admiration. A description of the chief details characteristic of the different styles, and of the various internal features of a church, will form the subject of another paper.



INTERIOR OF THE TEMPLE CHURCH, LONDON.

LESSONS IN ALGEBRA.—VI.

MULTIPLICATION (continued).

RULE FOR SIGNS IN THE PRODUCT.

81. The rule is that + into + produces +; — into + gives —; + into — gives —; and — into — gives +; or, in words, plus multiplied by plus gives plus; minus by plus gives minus; plus by minus gives minus; and minus by minus gives plus; that is, if the signs of the factors are ALIKE, the sign of the product will be plus, or affirmative; but if the signs of the factors are UNLIKE, the sign of the product will be minus, or negative.

82. The first case, viz., that of + into +, needs no explanation, being the same as that of ordinary numbers.

83. The second case is — into +, that is, the multiplicand is negative, and the multiplier positive. Thus, —a into +4 is —4a. For the repetitions in the multiplicand are —a —a —a —a = —4a.

EXAMPLES.—(1.) Multiply $2a - m$ By $3h + x$ (2.) $h - 3d + 4$ By $2y$

Product: $6ah - 3hm + 2ax - mx$ $2hy - 6dy + 8y$

(3.) Multiply $a - 2 - 7d - x$ By $3b + h$

Product: $3ab - 6b - 21bd - 3bx + ah - 2h - 7dh - hx$

84. In the two preceding cases, the positive sign prefixed to the multiplier shows that the repetitions of the multiplicand are to be added to the other quantities with which the multiplier is connected. But in the two remaining cases, the negative sign prefixed to the multiplier indicates that the sum of the repetitions of the multiplicand are to be subtracted from the other quantities. This subtraction is performed at the time of multiplying, by making the sign of the product opposite to that of the multiplicand. Thus +a into —4 is —4a. For the repetitions of the multiplicand are, +a +a +a +a = +4a. But this sum is to be subtracted from the other quantities with which the multiplier is connected. It will then become —4a [Art. 58]. Thus in the expression $b - (4 \times a)$ it is manifest that $4 \times a$ is to be subtracted from b. Now $4 \times a$ is 4a, that is, +4a. But to subtract this from b, the sign + must be changed into —. So that $b - (4 \times a)$ is $b - 4a$. And $a \times -4$ is therefore —4a.

Again, suppose the multiplicand is a, and the multiplier (6 — 4). As (6 — 4) is equal to 2, the product will be equal to 2a. This is less than the product of 6 into a. To obtain, then, the product of the compound multiplier (6 — 4) into a, we must subtract the product of the negative part from that of the positive part. Thus, multiplying a by 6 — 4 is the same as multiplying a by 2. And the product of the former, viz., 6a — 4a, is the same as the product of the latter, viz., 2a. But if the multiplier be (6 + 4), the two products must be added. Thus, multiplying a by 6 + 4, is the same as multiplying a by 10. And the product of the former, viz., 6a + 4a, is the same as the product of the latter, viz., 10a.

This shows at once the difference between multiplying by a positive factor, and multiplying by a negative one. In the former case, the sum of the repetitions of the multiplicand is to be added to, in the latter it is to be subtracted from, the other quantities with which the multiplier is connected.

EXAMPLES.—(1.) Multiply $a + b$ By $b - a$
Product: $ab + b^2 - ax - bx$

(2.) Multiply $3dy + hx + 2$ By $mx - ab$

Product: $3dmxy + hmx + 2mx - 3abdy - abhx - 2ab$

(3.) Multiply $2h + 3$ By $ad - 6$

Product: $3adh + 3ad - 18h - 18$

85. If two negatives be multiplied together, the product will be affirmative: —4 × —a = +4a. In this case, as in the preceding, the repetitions of the multiplicand are to be subtracted, because the multiplier has the negative sign. These repetitions, if the multiplicand is —a, and the multiplier —4, are

—a —a —a —a = —4a. But this is to be subtracted by changing the sign. It then becomes +4a.

Suppose —a is multiplied by (6 — 4). As 6 — 4 = 2, the product is evidently twice the multiplicand, that is, —2a. But if we multiply —a into 6 and 4 separately, —a into 6 is —6a, and —a into 4 is —4a [Art. 83]. As in the multiplier, 4 is to be subtracted from 6; so, in the product, —4a must be subtracted from —6a. Now, —4a becomes by subtraction +4a. The whole product then is —6a + 4a, which is equal to —2a. Or thus, multiplying —a by 6 — 4, is the same as multiplying —a by 2; and the product of the former, viz., —6a + 4a, is equal to the product of the latter, viz., —2a. Hence the general rule may be thus stated:—When quantities are multiplied by a positive term, their signs are retained in the product; but when by a negative one, they are changed.

86. It is often considered a great mystery that the product of two negatives should be affirmative. But it amounts to nothing more than this, that the subtraction of a negative quantity is equivalent to the addition of an affirmative one [Arts. 58, 59], and therefore that the repeated subtraction of a negative quantity is equivalent to the repeated addition of an affirmative one. So, taking off from a man's hands a debt of ten pounds every month, is adding ten pounds a month to the value of his property.

EXAMPLES.—(1.) Multiply $a - 4$ into $3b - 6$. Answer. $3ab - 12b - 6a + 24$.

(2.) Multiply $3ad - ah - 7$ into $4 - dy - hr$. Answer. $12ad - 4ah - 28 - 3ady + adhy + 7dy - 3adr + ah^2r + 7hr$.

(3.) Multiply $2hy + 3m - 1$ into $4d - 2x + 3$. Answer. $8dhy + 12dm - 4d - 4xy - 6mx + 2x + 6hy + 9m - 3$.

87. Positive and negative terms may frequently balance each other, so as to disappear in the product. [Art. 53.]

EXAMPLES.

(1.) Multiply	$a - b$	(2.)	$mm - yy$
By	$a + b$		$mm + yy$
	$aa - ab$		$mmmm - mmyy$
	$+ ab - bb$		$+ mmyy - yyyy$
Product:	$aa - bb$		$mmmm - yyyy$
(3.) Multiply	$aa + ab + bb$		$aa + ab + bb$
By	$a - b$		$a - b$
	$aaa + aab + abb$		$- aab - abb - bbb$
	$aaa + aab + abb$		$- aab - abb - bbb$
	$aaa + aab + abb$		$- aab - abb - bbb$

88. For many purposes it is sufficient merely to indicate the multiplication of compound quantities, without actually multiplying the several terms. Thus [Art. 23], the product of

$a + b - c$ into $h + m + y$, is $(a + b - c) \times (h + m + y)$.

EXAMPLES.—(1.) What is the product of $a + m$ into $h + x$ and $d + y$? Answer. $(a + m)(h + x)(d + y)$.

By this method of representing multiplication, an important advantage is often gained, in preserving the factors distinct from each other. When the several terms are multiplied in form, the expression is said to be expanded.

(2.) What does $(a + b) \times (c + d)$ become when expanded? Answer. $ac + ad + bc + bd$.

89. With a given multiplicand, the less the multiplier, the less will be the product. If, then, the multiplier be reduced to nothing, the product will be nothing. Thus $a \times 0 = 0$. And if 0 be one of any number of fellow-factors, the product of the whole will be nothing.

EXAMPLES.—(1.) What is the product of $ab \times c \times 3d \times 90$? Answer. 0.

(2.) And $(a + b) \times (c + d) \times (h - m) \times 0$? Answer. 0.

(3.) Multiply $1 + x + x^2 + x^3 + x^4 + x^5$ by $1 - x + x^2$. Ans. $1 + x^2 + x^3 + x^4 + x^5 + x^7$.

(4.) Multiply $1 + x + x^2 + x^3 + x^4 + x^5$ by $1 - x + x^2 - x^3$. Ans. $1 + x^2 + x^4 - x^6 - x^8 - x^{10}$.

(5.) Multiply $a + 2b + c$ by $a - c$. Ans. $a^2 + 2ab - 2bc - c^2$.

(6.) Find the continual product of $xy - 1$, $xz - 1$, and $yz - 1$. Ans. $x^2y^2z^2 - x^2yz - xy^2z - xyz^2 + xy + yz + xz - 1$.

(7.) Find the continual product of $x^2 + yz$, $y^2 + xz$, and $z^2 + xy$. Ans. $2x^2y^2z^2 + x^2yz + x^2z^2 + y^2xz + y^2z^2 + xyz^2 + x^2yz + x^2z^2 + y^2xz + y^2z^2 + xyz^2 + x^2yz$.

(8.) Multiply $a^2 + b^2 + c^2 - ab - ac - bc$ by $a + b + c$. Ans. $a^3 + b^3 + c^3 - 3abc$.

From the principles explained in Articles 66 to 89 we derive the following general rule for multiplication:—

90. RULE.—Multiply the letters and co-efficients of each term in the multiplicand by the letters and co-efficients of each term in the multiplier; and prefix to each term of the product the sign required by the principle, that like signs produce +, and unlike signs —; lastly, unite such terms as are similar.

Otherwise.—Multiply every part of the multiplicand by every part of the multiplier, and collect the results as in addition.

EXERCISE 6.

1. $6x \times 3ay$.
2. $2a + 1 \times 2a - 1$.
3. $2a + 1 \times 2a - 1$.
4. $2a \times 2a$.
5. $2a \times 2a$.
6. $2a^2 \times 2a^2$.
7. $2a^2 - 3a^2y + 3xy^2 \times axy$.
8. $1 - 2x + 3x^2 - 4x^3 \times 1 + x$.
9. $x^2 + 2ax + a^2 \times x^2 - 2ax + a^2$.
10. $x - 2x \times 2x - 3x$.
11. Multiply $a + 3b - 2$ into $4a - 6b - 4$.
12. Multiply $4ab \times x \times 2$ into $3my - 1 + h$.
13. Multiply $(7ah - y) \times 4$ into $4x \times 3 \times 5 \times d$.
14. Multiply $(6ab - hd + 1) \times 2$ into $(3 + 4x - 1) \times d$.
15. Multiply $3ay + y - 4 + h$ into $(d + x) \times (h + y)$.
16. Multiply $6ax - (4h - d)$ into $(b + 1) \times (h + 1)$.
17. Required the continual product of $a + b + c$, $-a + b + c$, $a - b + c$, and $a + b - c$.
18. Find the product of $x^2 - y^2 + z^2 - v^2 \times x^2 + y^2 - z^2 - v^2$.
19. Find the continual product of $2x - y$, $2x + y$, and $4x^2 + y^2$.
20. Multiply $a + b$ into $a + b$ into $a + b$.
21. Multiply $x + y$ into $x - y$ into $x + y$.
22. Multiply $4(x + y)$ into $3a$ into $6b$ into 3.
23. Multiply $3(a + b + c + d)$ into xyz .
24. Multiply $ax + xy + yy$ into $x - y$.
25. Multiply $aaa - bbb$ into $aaa + bbb$.
26. Multiply $aa - ax + xx$ into $a + x$.
27. Multiply $yyy - ayy + ayy - aaa$ into $y + a$.
28. Multiply $15a + 20bb$ into $3a - 4bb$.
29. Multiply $3a(x + y) \times 4$ into $a + b$.
30. Multiply $aa + 2ab + bb$ into $a + b$ into $a + b$.
31. Find the product of $x - 2x^2 + 3x^3 \times 4x^4 + 5x^5 - 6x^6$.
32. Find the product of $5y^5 - 7y^4 - 8y^3 + 3y^2 + y \times 7y - 8$.
33. Find the product of $a^3 - 2a^2 + 3 \times a^3 + 2a - 3$.
34. Find the product of $v^4 - 4av^3 + 6a^2v^2 - 4a^3v + a^4 \times v^3 - 3av^2 + 3a^2v - a^3$.
35. Find the product of $x^3 - ax^2 + 2x^2 \times x^2 - ax + 2a^2$.
36. Find the continual product of $x - 1$, $x + 2$, $x + 4$, and $x - 5$.
37. Multiply $1 - x + x^2 - x^3 + x^4 - x^5$ by $1 + x + x^2$.

THE HISTORY OF ART.

XIV.—THE DUTCH SCHOOL.

HOLLAND is the land of toilsome and painstaking labour, the masterpiece of man's victory over the brute forces of nature. The soil itself in many places has been won from the sea by a laborious system of dykes and ramparts; and it is only preserved for its inhabitants by ceaseless and unrelenting watchfulness. All the mental characteristics of the Dutch have been begotten by the peculiar circumstances under which they live. The care they have to exercise in merely keeping out the ever-encroaching sea; the pains they require in pumping and draining their land; the minute patience needed in merely guarding and cultivating their soil—all these things have reacted generation after generation on the national mind, and have made the Dutch the most frugal, industrious, and ingenious nation in Europe. The same causes have led to a general spread of wealth and well-being throughout the masses in Holland: everybody is fairly well off, and everybody lives in a style of much comfort and ease, and even in some simple luxury. Hence Dutch art has always taken a peculiarly democratic and domestic turn. It has grown up among the people themselves, not among a small aristocratic class; and it has busied itself about the subjects in which the people as a whole feel a personal interest. All Dutch painting is very minute, painstaking, and careful of detail. The artists have been trained in a school of life where they learnt to do everything with much exactness. Their subjects have been defined for them to a great extent by the nature of the country, and to a great extent also by the nature

of the people for whom they painted. Holland is not a land of any natural sublimity in any way: it has no great mountains, no vast rocks, no waterfalls, no forests, and no magnificent scenery of any sort. Thus, in the matter of landscape, Dutch painters have been necessarily restricted to the ordinary flat and somewhat dull features of the country as seen in Holland. Quaint old towns, with tall, brick-fronted houses; canals lined with tall poplars, and overlooked by stately yet homely mansions; flat fields and roads, with little comical Dutch churches; everything trim and neat and quiet, with a certain formal prettiness of its own, but no pretence to grandeur in any way—this is what we get in the ordinary landscape painting of the Netherlands. Historical pictures of the usual grandiose type are also almost unknown; for Holland has had little history of the common sort, and what history it has had has not been of a very pictorial character.

Again, the style of art demanded by the Dutch people was one of a peculiarly domestic and somewhat undignified kind. The comfortable and wealthy burghers of the great towns required their own portraits and those of their motherly wives to be painted for them—heavy and rather coarse-looking heads, rendered with perfect fidelity and very little attempt at flattery by truthful and minutely-accurate artists. Besides these, they liked to see their houses and their tulip-gardens put on canvas for them, the familiar streets of their own clean and bright cities, the peaceful canals and long avenues of their country resorts. They appreciated also the little half-humorous scenes of everyday life, rendered in a style of careful caricature or grotesque exaggeration—an apple-woman in the market-place, a group of boys playing in the street, a rural merry-making, a couple of old tavern cronies, sitting over their foaming mugs at the village inn. But beyond such themes their artists seldom ventured. Dutch art, in fact, is the product of essentially commonplace feeling, and produced for commonplace minds, though often elevated by the extremely high character of its technical execution into the very first rank of artistic production.

The Flemish painters, Teniers, father and son, may be considered as a connecting link between the Dutch school and its southern predecessors. The elder Teniers was an Antwerp man, and studied under Rubens, but his own style was quite novel, and exhibits strikingly the gradual transformation of art from its older sacred associations to its modern and purely æsthetic purpose. He painted chiefly scenes of low life, such as village fairs and merry-makings, with a profusion of big, jolly, beer-drinking boors and stout Flemish housewives crouching and junketing in true careless low Dutch fashion. His humour is inimitable, but it is also mixed up with much gross animalistic coarseness. The younger Teniers for the most part followed his father, but his technique is more finished, and he spent more pains upon his rustic pictures.

In Holland proper—that is to say, in the northern part of the United Provinces—a native school of painting had begun to develop itself, at Leyden and elsewhere, from the middle of the fifteenth century, and even at an early period it produced some painters of repute, such as Aartgen. It was not till the beginning of the seventeenth century, however, that Dutch art began to reach its culminating point. The greatest name among the Dutch painters is unquestionably that of Rembrandt, who nevertheless has fewer of the characteristic marks of the school than any other. Rembrandt was born at Leyden, the metropolis of art and culture for the whole of the Netherlands, in 1606. He was a painter, engraver, and etcher; but he was entirely home-taught, and his merits and defects are peculiarly his own. He particularly devoted himself to portrait painting, in which he excelled. His treatment of light and shade is unique, and though it shows much mannerism, and is not wholly true to nature as ordinarily seen, it yet marks out his strong individuality of touch. Rembrandt delighted in massive depths of shadow, throwing up the face or other main portions of his work into a high relief of brilliant light. As a rule, his background is rendered in the most sombre and heavy shade, while a powerful beam is cast upon the principal part of the picture. The effect is one of a somewhat lurid but grandiose character, while at the same time the gloom of the whole work often almost oppresses one by its powerful suggestiveness. Rembrandt's colouring is also peculiarly sober; he never indulges in the bright tones of many southern painters, but seems

to exhibit a sort of reserve, or quiet, self-contained power over his distribution of hues. Energy and force of character is the distinguishing mark of Rembrandt's style: at times he is almost coarse in his bold delineations, but he is always saved from such faults as those of Rubens by the innate delicacy of his perceptions. The man's very face, which may be seen in

Philosopher," which also forms one of our illustrations, shows his characteristics less markedly, perhaps, but it has great depth and earnestness, with a certain sturdy simplicity of treatment which is essentially Rembrandtesque. Rembrandt's etchings are almost as famous as his paintings, and the British Museum contains a large collection of them. He died in 1669.



THE PHILOSOPHER. (By Rembrandt.)

his own portrait, here engraved, gives us the keynote to his artistic character. There is in it much strong force, together with a certain air of originality, bordering on bravado; and yet underneath the apparent coarseness of its flat Dutch features lurks a great deal of real refinement, especially observable in the mouth and lower part of the face. Rembrandt was rather fond of painting his own portrait, and, indeed, the subject suited his vigorous pencil far better than many of the stout and complacent Dutch burgomasters, upon whose heads he spent perforce too much of his time. The portrait known as "The

Albert Cuyp, another great Dutch painter, was a contemporary of Rembrandt. He was born at Dort in 1606, the same year as his great countryman, and gave himself up mainly to landscape art. As a colourist he stands amongst the first rank, and his management of light is peculiarly brilliant. He was one of the few painters who have really succeeded in "painting air." Cows and other animals generally form part of his landscapes, which are usually of a very soft and mellow character. His pieces are usually very Dutch in subject, representing gentle plains, intersected by water, and sometimes with a few

figures interspersed. He was also fond of hunting scenes and still life. Like most other Dutch artists, Cuyp painted with minute care and accuracy, and most of his pieces are finished in execution to an unusual degree.

Philip Wouvermans, of Haarlem (1620-1668), was also a distinguished representative of the Dutch school. He had, however, far more versatility than most of his contemporaries, and he was distinguished by a great deal of verve and a comparatively dashing style. Landscape was the central point of Wouvermans' art, but he also painted many boar-hunts and other similar sporting scenes, besides several battle pieces. About the same time lived the two Vanderveldes, father and son, who devoted themselves to marine painting, and who have left on canvas for us the cumbersome old men-of-war of the period of Charles II. Both of them settled in England, where most of their sea pieces are still to be found. Perhaps, however, the most typical of all the Dutch school of painters was Gerard Douw, of Leyden (1613-1675), a pupil of Rembrandt, and probably the second in rank after that great master amongst all the artists of the Netherlands. His pictures are usually small, but they have the characteristic Dutch elaboration carried to the very highest degree, and are marvels of minute patience and careful finish. "They showed household incidents, mostly of a culinary kind, and expressed, in a quiet unostentatious way, domestic peace, or even piety, which procured for their author, even in his own time, both wealth and reputation." One of the largest and most important of his few sacred subjects is the blind Tobit going to meet his son, a picture which is in the possession of Lord Arundel.

Ruysdael, of Haarlem, a distinguished landscape painter, especially celebrated for his waterfalls, cannot be passed over, even in so rapid a sketch; and his pupil, Hobbema (1638-1687), who also devoted himself to landscape, was likewise characteristically Dutch in his treatment. Hobbema, although one of the first of Dutch landscape painters, remained almost unknown among his countrymen for nearly a hundred years, and England seems to have been the first to recognise his merit.

Flower-painting and still life were always favourite Dutch subjects, often treated with all the careful and painstaking detail of a miniature. One of the first to devote himself exclusively to flower-painting was David de Heem (1603-1674), who was followed by his son, Cornelius de Heem. Other notable painters were Maria Van Oosterwyck (1630-1693), and Jan Van Huysum (1682-1749). The detail and finish in this last painter's works were remarkable. The two Weenixes, also, father and son, especially excelled in painting flowers and still

life. The elder Weenix was celebrated for his pictures of birds, the younger for his admirable representations of dead game. Indeed, the seventeenth century in Holland is rich throughout in the names of distinguished artists, all belonging to a school narrowly limited in point of style, it is true, but marked throughout by a very high character of execution. There is little originality, and still less spirit or ideality, in Dutch art, but there are the very best qualities of hand and eye. A trifle mechanical in design, the painters of the Netherlands are yet minutely and patiently accurate in their delineation of nature; and it is such workmanship that gives so high a value to the works of their best age.



REMBRANDT.



LANDSCAPE. (By Cuyp.)

READINGS IN FRENCH.—V.

MDLLE. DE LAJOLAIS.

SECTION III.

Le saisissement de la joie fut plus dangereux pour Mlle. de Lajolais que la douleur.¹ La pauvre enfant tomba lourdement et sans connaissance (a) sur le marbre de la galerie.²

Grâce aux soins de l'impératrice, de la Princesse Hortense et de leurs dames, Mlle. de Lajolais reprit bientôt connaissance (b). "Mon père, mon père!" murmura-t-elle aussitôt qu'elle put (c) parler. "Oh! que je sois (d) la première à lui annoncer sa grâce!"

Et se levant, elle voulut s'échapper des bras qui la retenaient; mais trop faible pour tant d'émotions diverses, elle y retomba sans force.

"Rien ne presse maintenant, Mademoiselle," dit une des dames; "prenez (e) un peu de repos et de nourriture; vous irez (f) une heure plus tard."³

"Une heure plus tard!" se récria Maria; "vous voulez que je retarde d'une heure l'annonce de la vie à un homme condamné à mort, surtout quand cet homme est mon père. Oh! Madame," ajouta-t-elle, se tournant vers l'impératrice, "laissez-moi partir de grâce (g); songez que c'est mon père: qu'il a sa grâce, et qu'il ne le sait (h) pas encore."

"Soit (i), mon enfant," lui répondit l'excellente Joséphine; "mais vous ne pouvez aller seule à sa prison."⁴

"Je suis bien venue seule à votre château,"⁵ répondit-elle vivement (j).

"Que (k) votre majesté nous permette d'accompagner Mlle. de Lajolais,"⁶ demandèrent à la fois plusieurs officiers et aides-de-camp de l'Empereur, que l'action pourtant bien naturelle de Mlle. de Lajolais avait remplis d'admiration.

"M. de Lavalette* me rendra ce service,"⁷ dit l'impératrice, souriant (l) gracieusement à l'un d'eux; "ainsi que Monsieur (désignant un aide-de-camp de service). Vous vous servirez (m) d'une de mes voitures; allez, Messieurs, je vous confie Mlle. de Lajolais."

Bien qu'épuisée de fatigue, de besoin et d'émotion, Maria refusa de prendre et nourriture et repos.⁸ Elle voulut elle-même voir atteler les chevaux, presser les gens,⁹ et ne se tint en place (n) que lorsqu'elle et ses conducteurs furent installés sur les coussins de la voiture.¹⁰

COLLOQUIAL EXERCISE.

1. La jeune fille put-elle résister à tant de joie?
2. Où tomba la pauvre enfant?
3. Que dit-elle aussitôt qu'elle put parler?
4. Que voulut-elle faire en se relevant?
5. Quo lui dit une des dames?
6. Que répondit-elle à cette dame?
7. Que dit-elle alors à l'impératrice?
8. Que lui répondit la bonne Joséphine?
9. Qu'ajouta vivement Mlle. de Lajolais?
10. Quelle demande les officiers adressèrent-ils à l'impératrice?
11. Que dit Joséphine en parlant de M. de Lavalette?
12. Le général était-il allié à la famille de Joséphine? (See footnote.)
13. Par qui fut-il sauvé en 1815?
14. Comment le saura-t-elle?
15. De quelle voiture devait-on se servir?
16. Maria prit-elle du repos alors?
17. Que fit-elle?
18. Quand se tint-elle en place?

NOTES.

- (a) Sans connaissance, senseless.
(b) Reprit bientôt connaissance, soon recovered; from reprendre.
(c) From pouvoir.
(d) Que je sois, let me be.
(e) From prendre.
(f) From aller.
(g) De grâce, I beseech you.
(h) From savoir.
(i) Soit, be it so.
(j) Vivement, hastily.
(k) Quo, will; literally, let.
(l) From sourire.
(m) Vous vous servirez, you will use.
(n) Ne se tint en place, did not rest; literally, did not keep herself in one place.

SECTION IV.

Alors la voiture partit au galop de six bons chevaux: elle franchit avec une rapidité incroyable la distance qui séparait Saint-Cloud de la prison.¹ Pendant tout le trajet, Maria, droite

* Le général Lavalette avait épousé une nièce de l'impératrice. Condamné à mort en 1815, il fut sauvé par le généreux dévouement de sa femme, qui s'introduisit dans sa prison, et changea de vêtements avec lui.¹⁴

et raide,² tenait (a) les yeux fixés sur le chemin qu'elle avait encore à parcourir (b); son regard semblait vouloir dévorer la distance;³ sa poitrine haletait, comme si c'était elle, au lieu des chevaux, qui traînaient (c) le carrosse, et elle était pâle, si pâle, que deux ou trois fois ses compagnons lui adressèrent la parole, mais inutilement, elle ne les entendait pas.⁴ Quand la voiture s'arrêta, elle s'élança par-dessus le marche-pied⁵ avant que M. de Lavalette eût eu le temps de lui offrir la main pour descendre, et ne pouvant (d) articuler que ce mot, "Vite, vite!" Elle parcourait les longs corridors de la prison,⁶ précédant le geôlier et ses guides, et répétant toujours, "Vite, vite!" Arrivée à la porte du cachot, il fallut bien qu'elle attendît (e) que (f) le geôlier en eût ouvert la serrure,⁷ et tiré deux énormes verrous; mais à peine (g) la porte eut-elle cédé (h), que, se précipitant dans l'intérieur, elle alla tomber dans les bras de son père,⁸ en criant, "Papa, l'Empereur... la vie... grâce..." Elle ne put achever: sa voix se perdait en longs (i) cris, chaque parole commencée finissait par un sanglot.

Le général de Lajolais crut (j) un instant qu'on venait le chercher (k) pour le conduire à la mort,⁹ et que sa fille ayant trompé la vigilance des gardiens, avait tout bravé pour lui faire ses adieux (l).

Mais M. de Lavalette le détrompa bientôt;¹⁰ voyant que Maria vaincue (m) par l'émotion ne pouvait articuler un son, il prit la parole:

"L'Empereur vous accorde votre grâce, général," lui dit-il, "et vous la devez au courage et à la tendresse de votre fille."¹¹

Puis avec une émotion dont il ne pouvait se défendre, il raconta au général de Lajolais tout ce que sa fille avait fait pour lui.¹²

Oh! combien elle était heureuse cette jeune fille!¹³ combien ce moment compensait et bien au-delà, tout ce qu'elle avait souffert jusqu'alors; souffert! avait-elle réellement souffert? Elle ne s'en souvenait (n) plus. Toutes ses souffrances s'étaient effacées (o)¹⁴ devant son père qui la serrait avec transport dans ses bras. Il faut avoir souffert soi-même,¹⁵ il faut avoir été séparé des auteurs de ses jours (p), et avoir tremblé pour leur vie, pour comprendre tout ce que ce moment de réunion avait de saint (q), de délicieux, d'ineffable.

E. MARCO DE SAINT-HILAIRE.

COLLOQUIAL EXERCISE

1. La voiture transporta-t-elle Maria rapidement?
2. Que faisait-elle pendant tout le trajet?
3. Où son regard se portait-il?
4. Entendait-elle ce qu'on lui disait?
5. Que fit-elle quand la voiture s'arrêta?
6. Entra-t-elle dans les corridors de la prison?
7. Ne lui fallut-il pas attendre à la porte du cachot?
8. Que fit-elle quand la porte fut ouverte?
9. Que crut d'abord le général?
10. Par qui fut-il détrompé?
11. Que lui dit-il alors M. de Lavalette?
12. Que lui raconta-t-il ensuite?
13. Que dit l'auteur, du bonheur de la jeune fille?
14. Ses souffrances étaient-elles présentes à son esprit?
15. Que faut-il pour comprendre le plaisir d'une telle réunion?

NOTES.

- (a) Tenait, kept.
(b) Parcourir, to perform.
(c) From traîner.
(d) From pouvoir.
(e) Il fallut bien qu'elle attendit, she was obliged to wait.
(f) Que, that.
(g) À peine, scarcely.
(h) Cédé, been opened; literally, yielded, given way.
(i) Longs, prolonged.
(j) From croire.
(k) Chercher, to take.
(l) Faire ses adieux, bid him adieu.
(m) Vaincue, overcome; from vaincre.
(n) Souvenait, from se souvenir.
(o) S'étaient effacées, were forgotten; literally, obliterated.
(p) Auteurs de ses jours, parents.
(q) De saint, of holy.

KEY TO EXERCISES IN LESSONS IN FRENCH.

EXERCISE 121 (Vol. II, page 74).

1. When will you have a house built?
2. I shall have one built next year, if I receive my money.
3. Have you boiled that leg of mutton?
4. I have roasted it.
5. Has the cook warmed your broth?
6. He has not warmed it yet, but he will do it by and by.
7. Have you not sent for books?
8. We have not (sent for any), but we have sent for engravings.
9. Have you not frightened those little girls?
10. We have frightened them.
11. Will you pay attention to your work?
12. I shall pay attention to it.
13. Have you hurt that little girl?
14. I have not hurt her.
15. Have you not hurt that dog?
16. I have hurt it.
17. Where have you hurt your son?
18. I have

SECTION LXXIII.—ONAGRACEÆ, OR ONAGRADS.

Characteristics: Calyx adherent; petals two to four, equal in number to the divisions of the calyx; contorted in aestivation; stamens equal in number to the petals, or double; ovary inferior, two to four locular; ovules reflexed; fruit capsular or bacciform, two or four-celled; seeds winged, or with a tuft of hairs; seed dicotyledonous, exalbuminous.

The members of this natural order possess leaves without stipules; flowers sometimes axillary and solitary, sometimes in the form of a corymb or spike. They are chiefly extra-tropical, and belong for the most part to the northern temperate zone.

Two genera, *Epilobium*, or willow herb, and *Circæa*, or enchanter's nightshade, are mucilaginous. The ancients believed that the aqueous infusion of *Epilobium angustifolium* had the property of taming wild animals, and that its vinous tincture was exhilarant when administered to human beings. *Eriogonum biennis*, or biennial evening primrose, and *Eriogonum suavis*, or sweet-scented evening primrose, originally natives of North America, but now cultivated, like many of their congeners, in our gardens, possess a saccharine root, which is sometimes used as an article of food.

Fuchsias are elegant shrubs, indigenous to New Zealand and South America, now common enough in our gardens. They are remarkable for the beauty of their foliage, their petaloid calyx, and their convolute corolla.

The berries of certain New Zealand species yield an agreeable perfume.

SECTION LXXIV.—ANACARDIACEÆ, OR TEREBINTHES.

Characteristics: Flowers ordinarily dioecious by abortion; calyx free, or rarely adherent to the ovary; petals inserted upon a perigynous disc, or else upon a short stipes, equal in number to the divisions of the calyx; sometimes absent; imbricated in aestivation; stamens equal in number to the petals, and alternate with them, or in double or multiple number; carpels ordinarily reduced to one unilocular; or four to five distinct, one alone being fertile; ovule single, ascending, ordinarily free, curved or half-reflexed; fruit drupaceous or dry; seed dicotyledonous, exalbuminous, curved; stem woody; juice gummy or milky; leaves alternate and without stipules.

The *Anacardiaceæ* owe their properties to a resinous juice which in certain species resembles pine turpentine; in the greater number of species, however, this resinous principle is mixed with certain acrid matters, which, on contact with the air, become black, and impart to the secretion very stimulating, sometimes venomous, properties. The bitter and astringent principles which some individuals of this natural order contain in their bark and wood modify the action of the stimulating matter. The fruit of certain species is fleshy, abundant in sugar and free acids; sometimes edible. The seeds contain a fixed oil.

The *Pistacia Lentiscus*, or mastic tree (Fig. 228), a plant cultivated in the Grecian Archipelago, and the *Pistacia atlantica*, a native of the Mauritius, are valuable for their product—mastic. This substance, employed by ourselves as the basis of several varnishes, is largely used by Orientals as a masticatory, whence its name. By these persons it is believed to purify the breath. The *Pistacia Terebinthus*, or turpentine tree, grows spontaneously in the whole Mediterranean region. From its trunk flows a limpid adhesive juice, yellowish-blue in colour, and of a penetrating odour, something between that of citron and fennel. Its taste is balsamic, exempt from bitterness and acidity. This substance, known as *Scio turpentine*, is rarely pure, and chemistry is unequal to detect the fraud. Its seeds, formerly employed in passive hemorrhages and dysentery, are at present held in but little repute. The *Pistacia vera*, or true pistachia tree, originally a native of Persia and Syria, is now grown in the whole Mediterranean region; its oily seeds, under the name of *green almonds*, are very agreeable in taste, and are employed by druggists in France as the basis of certain emulsions.

The mango (*Mangifera Indica*) is a tree originally of Asia, but it is now cultivated in many tropical regions for the sake of its fruit. This is very agreeable in taste, but it must be sparingly partaken of, for much constitutional disorder results.

In exchange for the mango which America has received from

hurt his arm and hand. 19. Have you not hurt his foot? 20. I have hurt his shoulder. 21. Whom has that mason hurt? 22. He has hurt nobody. 23. Have I hurt your foot? 24. You stepped on my foot and hurt me. 25. My head, shoulder, arm, wrist, and hand hurt me.

EXERCISE 122 (Vol. II, page 75).

1. Ferez-vous recommander votre habit?
2. Je ne le ferai pas recommander.
3. M. votre frère ne fera-t-il pas peindre sa maison?
4. Il la fera peindre l'année prochaine.
5. Ne ferez-vous pas faire un habit?
6. J'en ferai faire un si j'avais de l'argent.
7. Avez-vous fait mal à votre frère?
8. Je lui ai fait mal, je lui ai marché sur le pied.
9. Le bras lui fait-il mal?
10. Oui, Monsieur, l'épaule, le bras et le poignet lui font mal.
11. Votre fils ne fera-t-il pas attention à son travail?
12. Il y fera attention, il n'a rien autre chose à faire.
13. Vous ai-je fait mal à la main ou au coude?
14. Vous m'avez fait mal au doigt.
15. Votre cuisinier sait-il faire la cuisine?
16. Il sait faire la cuisine.
17. Le cuisinier a-t-il fait rôtir ce gigot de mouton?
18. Il l'a fait bouillir.
19. Ne l'a-t-il pas fait chauffer?
20. Il n'a pas eu le temps de le faire chauffer.
21. Le médecin a-t-il fait venir des gravures?
22. Il a fait venir des livres.
23. Lui avez-vous fait mal au coude?
24. Je ne lui ai pas fait mal au coude, mais à la main.
25. Ne vous ai-je pas fait mal aux doigts?
26. Vous m'avez fait mal au poignet.
27. Où avez-vous fait mal à votre fils?
28. Je ne lui ai pas fait mal.
29. Le cuisinier ferait-il bouillir cette viande, s'il avait le temps?
30. Il ne la ferait pas bouillir, il la ferait rôtir.
31. Quand fera-t-il chauffer votre bouillon?
32. Il le fera chauffer tout à l'heure, s'il a le temps.
33. Si vous m'avez marché sur le pied, ne m'auriez-vous pas fait mal?
34. Je vous aurais fait mal, certainement, si je vous avais marché sur le pied.

EXERCISE 123 (Vol. II, page 106).

1. Would you be glad to become acquainted with that gentleman?
2. I should be very glad of it.
3. Does that horse go a league in a quarter of an hour?
4. He went a league this morning in twelve minutes.
5. Have you asked them questions?
6. I have (asked them some).
7. What questions have you asked them?
8. I have asked them if they had made purchases.
9. Do your pupils improve in their studies?
10. They do not improve much, they seldom come to school.
11. If you were at home, would you pretend to sleep?
12. I should not certainly pretend to sleep.
13. Why do you not let in that beggar?
14. My mother has just given him alms.
15. Does the merchant use his credit?
16. He uses it.
17. Of what food does that sick man make use?
18. He makes use of rice and broth.
19. Are you doing your best to succeed?
20. I am doing my best.
21. Have you let in those children, or have you made them go out?
22. I left them where they were.
23. Have we kept you waiting?
24. You have kept us waiting several hours.
25. If you kept those ladies waiting, they would be angry.

LESSONS IN BOTANY.—XXX.

SECTION LXXII.—GROSSULARIACEÆ, OR CURRANT-WORTS.

Characteristics: Calyx tubular, adherent, prolonged to a varying extent above the ovary; petals inserted upon the throat of the calyx, equal in number to the divisions of the latter; aestivation imbricated; stamens equal in number to the petals and alternate with the latter; ovary inferior and one-celled; placentæ usually two, parietal or attached to the valves; ovules horizontal, reflexed; berry pulpy; seeds angular, dicotyledonous; embryo straight in the base of an almost corneous albumen.

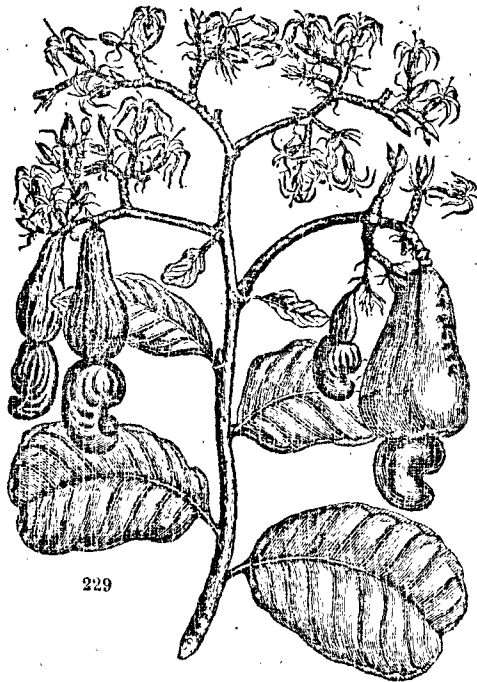
Members of this natural order are sometimes armed with spines situated below the leaf; the leaves are alternate or fasciculated; limb palmi-lobed; petiole dilated. The flowers are disposed in axillary racemes in the species which are deprived of spines; they are solitary or few in number in the spine-bearing species. The berry is surrounded by the persistent tube of the calyx. The seeds have a gelatinous testa, in which a long raphé, or cord running between the outer and inner coverings of the seed, ramifies. The endosperm is adherent to the albumen.

The *Grossulariaceæ* are for the most part inhabitants of the temperate and cool regions of the northern hemisphere. The genus *Ribes* constitutes nearly all the family to which it imparts the distinctive name. Its species contain in their herbaceous portion a resinous aromatic principle. Their fruit is filled with a saccharine mucilage in combination with malic and citric acids, and occasionally astringent matters. The white currant (*Ribes rubrum*) variety, an illustration of which is given in Fig. 227, affords a good example of the genus.

Gooseberry and currant trees are so well known that any prolonged description of them would be useless. They are amongst the most delicious of cultivated fruit, and furnish no bad substitute for the vine as a wine-making material.

Asia, the latter continent and Africa have derived from America the cashew-tree (*Anacardium occidentale*, Fig. 229). It is indigenous to Central America and the West India Islands; its nut, small and reniform, termed the *cashew*, grows at the summit of a fleshy peduncle, like a large pear in general appearance. The pericarp contains a caustic oil; the seed is almond-tasted; the peduncle, named the cashew apple, is acidulous, saccharine, and a little acrid, but nevertheless agreeable. From the epicarp a blistering ointment is sometimes prepared, and the entire fruit is useful in certain diseases. Cashew gum exudes from the trunk of the tree, but it is applied to no useful purpose.

The *Anacardium Indicum* is a native of the East Indies. Its immature seeds yield a glutinous matter resembling birdlime, from which the celebrated Chinese varnish is prepared.



227. THE WHITE CURRANT (*ribes rubrum*) VARIETY. 228. THE MASTIC TREE (*pistacia lentiscus*).

The sumachs possess various properties. Fustic sumach (*Rhus Cotinus*, Fig. 230) is indigenous in eastern Europe; its bark, slightly aromatic and very astringent, is considered by some as a good substitute for that of Cinchona; its leaves are also employed in medicine, and from its wood a yellow dye-stuff is extracted. The Currier's sumach (*Rhus coriaria*) is a native of the Mediterranean region. Its acid fruits are used by the Turks as a condiment; its leaves and young shoots are employed by curriers and dyers. The fruit and flowers of the *Rhus typhina*, *Rhus glabra*, and *Rhus*

elegans, all natives of North America, are employed as condiments. The Jamaica sumach (*Rhus metopii*) secretes a purgative gum resin from its bark. The *Rhus vernix*, or varnish sumach, is a Japanese shrub, from the stem of which is obtained, by incision, a milky juice, which thickens and turns

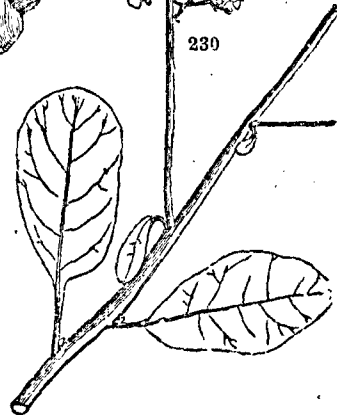
black when exposed to the air, and which, after being dissolved in a drying oil, constitutes the celebrated black Japanese varnish. The *Rhus radicans* and *Rhus Toxicodendron* are both natives of North America, and but slightly distinguishable from each other. When the period of flowering arrives, both these plants secrete an abundant quantity of milky juice, which turns black in contact with the air. This juice is so exceedingly acrid, that if a person sits in the shade of one of the poison sumachs, his skin becomes violently inflamed, reddens, swells, and is covered with pustules. The leaves of this sumach are recommended in paralysis, darts, and affections of the skin, and even consumption.

There are certain species of *Schinus* which emit noxious effluvia. The *Schinus molle* furnishes a mastic which is slightly purgative. Its bark

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229. THE CASHEW-NUT TREE (*ANACARDIUM OCCIDENTALE*). 230. THE FUSTIC SUMACH (*RHUS COTINUS*).

and leaves are aromatic, and its drupe is saccharine. The *Duraoa dependens* is a little tree, a native of Chili, the infusion of the seeds of which are stomachic, diuretic, and anti-hysteria; moreover, an intoxicating drink named *chicha* is prepared from them. The decoction of its bark and the gum secreted by the tree are balsamic and healing when applied to wounds. The species of the genus *Spondias* are not without interest. The *Spondias purpurea*, or purple-fruited hog-plum, of the West Indies, has drupes

of an acidulated saccharine taste, very agreeable as food. The drupes of *Spondias lutea*, or yellow-fruited hog-plum, are smaller, but more useful, being employed as a medicine. The congener of the two spreading species is cultivated in the Friendly and Society Islands. Its fruit is very agreeable and wholesome, almost rivaling in delicacy the pine-apple.

LESSONS IN GEOLOGY.—V.

THE ACTION OF THE OCEAN.

THE waters of the ocean are never tranquil; their surface is subject to the action of the winds, and is therefore in constant motion; the tidal wave affects the lowest depths; whilst permanent currents traverse almost every sea.

Action of waves.—Every one who has stood on the sea-shore and watched the breakers roll in and dash themselves to spray against the cliffs, must have felt that the wearing action of water on the coast must be considerable. On shores which are bounded by chalk cliffs, the sea margin is rendered milky by particles of the chalk which the waves have separated from the rocks. This destroying action of the waves is visible on every coast. Where the sea-barrier is a hard and resisting rock, frequently cliffs stand out of the water some distance from the shore, indicating the place to which the mainland formerly stretched. Examples of this are of frequent occurrence along the Scottish coast and the west coast of England. If the sea-board be of a soft species of deposit, the action is of course much more rapid. Thus on the coast of Yorkshire, from Bridlington to Spurn, some thirty-six miles, the waves erode 2½ yards annually, so that the sea has encroached two miles since the time of the Romans. Many old maps of Yorkshire indicate that villages stood where now the waves hold undisputed possession, and ports mentioned in bygone history are no longer to be found.

The same destruction is taking place on the coasts of Norfolk and Suffolk. The seaport towns are being driven back by the encroaching waters. The sites they occupied years ago now form their harbours. Between Cromer and Mundesley, according to the Ordnance Survey of 1838, the cliff has receded at the rate of fourteen feet a year.

On the same coast, as in Yorkshire, many villages are only historical remembrances. The church tower of Eccles is still seen rising out of the sea-sand, but all other remnants of the village have long since succumbed to the action of the waves, or have been covered with the sand-hills which move along that coast. Dunwich, on the Suffolk coast, offers another remarkable instance of the destruction of the sea. What is now a small village was once a large and flourishing seaport; records of the town are preserved even from Domesday-book, from which we gather that the sea must have encroached on the land to the distance of several miles.

The *Goodwin Sands* are from three to seven miles distant from the Kentish coast, nearly opposite Ramsgate. Tradition relates that they were once the estates of the Earl Godwin. This is so far confirmed, that when in 1817 the Trinity Board proposed to erect a lighthouse on the sands, and for that purpose made several borings, they found that the shoals were not all composed of sand, but after a few feet of sand blue clay was reached, and finally chalk. If this be the case—and there is no reason for doubting the tradition—some idea may be had of the eroding power of the waves. The same record of devastation may be written of all the south coast, and for a detailed description the reader is referred to chapter xx. of "Lyell's Principles of Geology," and to the local histories of towns which are built along these shores. All coast lines are thus acted upon, the destructive operations being carried on with more or less activity, accordingly as the coast is low, the sea-cliffs of soft material, or of hard rock. We are not now considering the gains of the sea, or we might allude to the many terrible inundations which the histories of Holland and the adjacent low-lying countries chronicle, of vast tracts of land suddenly swept over by the sea, to the destruction of hundreds of villages, their inhabitants, and their cattle. It is true the persevering industry of the Dutch has raised dykes against their great enemy, and by enclosing many of the meers with such walls, and then pumping out their water, they have reclaimed from the devastator much of his prey. This is not our object. We only mention the action of the waves as they erode the shores they wash; the particles of matter they thus mix with their waters are swept away by currents, and in tranquil spots, or along the path of the current, the sediment reaches the bottom, and there forms a new deposit.

Of the various oceanic currents we shall first speak of the *tides*.—All bodies attract each other; the power of the force exerted depending upon the weight of the bodies and 65—N.E.

their distance from each other. The weight of any body is, in fact, the force with which the earth attracts that body to itself. The celestial bodies are all chained together by this force of attraction. The sun and the moon both exert an attractive influence on the earth, inducing our planet to approach to them; this attraction being counterbalanced by the centrifugal force, we describe a curve, which is the resultant of these two forces. But the surface of the earth consists of fluid and solid; the former, owing to its mobility, exhibits a greater tendency to obey the attractive influence, and therefore rises to meet the sun or the moon.

The sun, on account of his enormous bulk, exercises a much greater attractive force on the earth than the moon, but the solar tide is much less than the lunar tide, for this reason—that the moon, being nearer the earth, attracts the surface of the sea far more than its solid bed, and therefore the water rises in a heap underneath the satellite. The sun, on the other hand, being so distant, exerts nearly as much force on the surface as on the ocean-bed beneath, and therefore lifts up the water but very little. Identically the same effect is produced on that part of the earth most distant from the sun or moon, only in this case the ocean-bed is drawn towards those bodies more rapidly than the water, which is, in fact, left behind.

When the sun and moon are either in conjunction or opposition—that is, when the line joining them passes in the neighbourhood of, or directly through, the earth—then their attractive forces being united, the tidal wave will be at a maximum, forming "spring tides." If they be in "quadrature"—that is, if the lines drawn from their centres to the earth's centre form a right angle—then the tides will be at a minimum, or "neap tide" will result. It will be evident, then, that if the earth were a world of waters, each tidal wave would pass completely round the earth in twenty-four hours. The existence of continents materially modifies its transit, and it is driven from its course, and consequently retarded.

The great tidal wave takes its rise in the Antarctic Ocean. As it traverses the ocean the water is not raised more than a few feet; but when it enters a shallow sea, or an estuary, where the tide finds itself in a sort of funnel, then the rise is sometimes as much as seventy feet, as is the case in the Bay of Fundy. The wave is not a wave of transmission, but one of motion, and if the particles of water were destitute of all cohesion or friction among themselves, they would only rise and fall into the same place after the attraction had passed. A wave of this nature is illustrated by throwing a stone into a pond; the wavelets expand from the point of disturbance, but do not carry to the shore anything which floats on the surface of the water, such bodies only rising as it were to allow the wave to pass beneath them; this proves that the water had only an upward and downward movement as it formed the wave. We shall allude to this wave of motion in speaking of earthquakes. In mid-ocean the water under tidal influence moves only about twelve miles, but when the wave from a deep sea acts on the water of a shallow sea, or an estuary, then the tides are high. Local causes have great effect on the tides, so that at two seaports not many miles distant a difference of many feet is found in the high-water mark. For example, at the extremity of the Wash, between Norfolk and Lincolnshire, the tide rises twenty-four feet, at Lowestoft only seven or eight, at Cromer sixteen.

The rapidity of the flow is sometimes very great. It is said that in the Solway Frith the rising tide can overtake a man on horseback. As these tidal waves beat against the shores of every continent and island in the world, except those which bound inland seas, twice in each day, the wearing action on the shores must be immense; the ebb tide carries out the eroded matter, which is either deposited in the deep sea or swept away by currents, to subside at a distance.

Currents.—It is impossible to draw the limit which bounds the effect that ocean currents have in the re-distribution of the material of the earth's surface. We cannot conceive that vast volumes of water traverse the oceans without taking a very active part in geological work. Of their direct action on the bed of the seas through which they pass, we know little or nothing; at present they are chiefly looked upon as means of transportation.

The system of ocean currents may be thus described:—The trade winds, as is known, are caused by the heated air rising

in the equatorial regions, and the cold and more dense air flowing in from the poles to supply its place. As this sweeps the surface of the Antarctic Ocean it sets the water in motion, in the direction of the wind, producing what is called a *drift current*; but when once a large body of fluid is set in motion it exhibits little disposition to return to its tranquil state, and if it be acted upon by encouraging causes, a permanent current is produced. When the great *Antarctic drift current*, which is about 1,400 miles broad, abuts upon the west coast of South America, its waters are divided: one branch bends southwards, and sweeps round Cape Horn; the other flows northwards along the coast, until the projecting shoulder of Peru gives it a westerly direction, and it leaves the land and traverses the Pacific along the equator as the *equatorial current*; finally, it is lost among the East India islands.

A drift current appears off the west coast of Australia, going northwards, until it reaches a latitude of 15 degrees south, when it turns at right angles across the Indian Ocean. It is separated by the island of Madagascar: one branch takes a northerly direction, washing the coasts of Africa, Arabia, and India; the other branch, passing round the Cape of Good Hope, sets in northward as the *Atlantic current*; like the other two, near the equator it takes a westerly bend, crossing the Atlantic Ocean; striking against the angle of South America, one stream follows the coast of Brazil, the other sweeps round the Gulf of Mexico, passes the south of Florida, follows the coast line of the United States, re-crosses the Atlantic at 40 degrees north latitude, and pours its warm waters on the coasts of the British Islands and Norway. Besides these main systems of currents, there are several smaller and less important branches. Yet we have said enough to show that the waters of the ocean are in continual circulation, carrying the material eroded on one coast to distant areas of deposition. A remarkable proof of the capability of the gulf-stream to transport material is related by General Sabine. In 1822 he was on the coast of Africa, near Cape Lopez, when a vessel was wrecked; the following year he visited Hammerfest, in Norway, near the North Cape, and while he was there casks belonging to the same vessel were cast on shore. They must have crossed the Atlantic south of the equator, navigated the Gulf of Mexico, passed through the West Indies, rounded Cape Sable, re-crossed the Atlantic, the North Sea, and finally landed on the very north of Europe!

The great banks which exist and are carefully mapped are due to the accumulation of drifted matter; they are formed in tranquil places where the burden carried by the waters can be deposited. Off the Northumberland coast is the Dogger bank, which is 200 miles long, and sometimes sixty broad.

In many areas the trawling-nets of the fishermen bring up broken shells and other similar *debris*, which have been brought together by some current. There can be little doubt but these materials arrange themselves according to certain circumstances, and when a storm disturbs the bank and causes a new order of deposition, an arrangement of strata would result, which, if consolidated, would bear a great resemblance to a class of rocks called the Norfolk and Suffolk Crags.

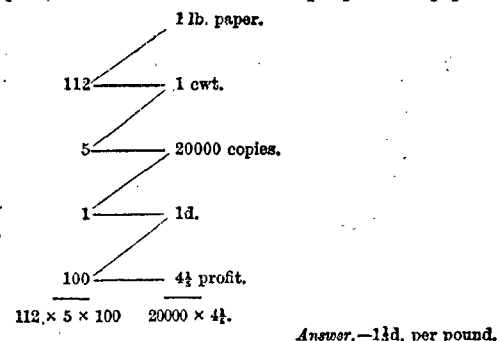
Between the coasts of Suffolk and the Netherlands oysters have been dragged up which were adhering to the bones of extinct elephants; and if these had been borne so far from the land by the water, specimens of existing animals must also be embedded in the strata in process of formation far out at sea. Our knowledge of the depositions going on at the bottom of the seas is necessarily very limited. All we can be sure of is, that the matter with which the waters of the sea becomes charged is deposited somewhere, and the deposition must be more or less homogeneous—that is, particles of the same specific gravity, and of much the same size, will reach the bottom about the same time. It has often been proved that near the shore the bottom of a sea not swept by a current is covered with gravel or shingle; further out the deposit gradually becomes finer; and at last, in deep water, the sounding leads bring up fine mud. Matter in a state of great sub-division, we know, requires a long time before it sinks to the bottom; for instance, barium sulphate is one of the heaviest of minerals, and yet when it is precipitated from a solution of baryta, some hours are required before the water is perfectly free from particles of the salt, so that the very fine particles may not reach the ocean-bed until they have been carried a great distance from the place where they entered the water.

We have thus rapidly reviewed the part which water plays in the degrading of existing land and the re-distribution of material upon the ocean-bed. The power thus employed is never-ceasing, and it is universal, and is capable of producing any alteration in the shape of continents and islands if sufficient time be allowed for its action. When we remember that our records of actual facts, sufficiently surprising in themselves, only extend back a few hundred years, what may we not ascribe to aqueous action in time not measured by years, but by ages?

LESSONS IN ARITHMETIC:—XLII.

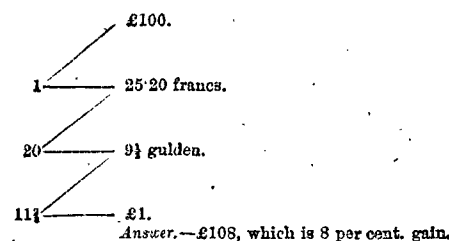
THE CHAIN RULE (continued).

EXAMPLE 5.—26,000 copies of a penny paper weigh a quarter of a ton, and a reduction in the price of paper increases the profit by $\frac{1}{4}$ per cent. What is the reduction per pound on paper?

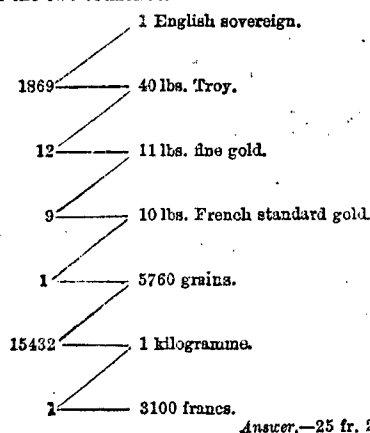


N.B.—Notice that evidently factors which are common to both columns may be cancelled.

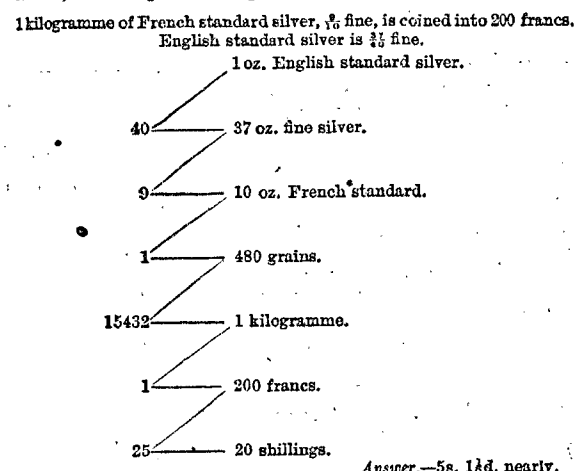
EXAMPLE 6.—A Bavarian gulden is equivalent to 60 kreutzers. When the exchange in London is 25 francs 20 cents, what shall I gain or lose per cent. by taking French gold instead of English to Bavaria, the exchange there being 11 gulden 40 kreutzers for an English sovereign, and 9 gulden 20 kreutzers for a French napoleon?



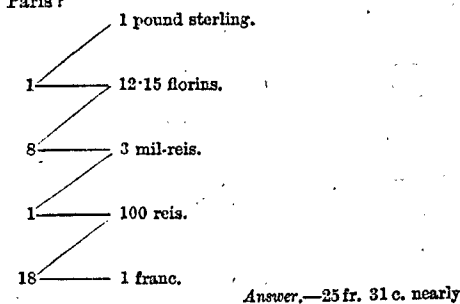
EXAMPLE 7.—1 kilogramme (15432 grains) of French standard gold, $\frac{9}{10}$ fine, is coined into 155 napoleons. Find the par of exchange between London and Paris, by comparing the gold coinage of the two countries.



EXAMPLE 8.—If the par of exchange, calculated from the comparison of the silver coinage of England and France, be 25 francs, find the price of English standard silver.



EXAMPLE 9.—Suppose the exchange between London and Amsterdam to be 12 florins 15 cents. for £1; between Amsterdam and Lisbon 8 florins for 3 mil-reis; between Lisbon and Paris 18 reis for 1 franc. What is the arbitrated price between London and Paris?



EXERCISE 62.

EXAMPLES TO BE WORKED BY THE CHAIN RULE.

1. A man spends £500 a year; how much does he spend a week?
2. Reduce £5 10s. 6d. to farthings.
3. The value of 33 bushels, at £1 4s. a quarter.
4. A man travels a certain distance in 15 days, at the rate of 27 miles a day; how long will he be in doing the journey if he travel 45 miles a day?
5. A dealer barter tea, at 3s. 4d. a pound, for 3 cwt. 2 qrs. of sugar, at 7d. a pound; how much tea does he give?
6. A bar of gold, weighing 210 oz., sells for £3 16s. an ounce; what is the value of 14 ingots, each weighing 4lb. 7 oz.?
7. 14 yards cost 2 guineas; what must 176 yards be sold for to gain 1s. 6d. per ell?
8. What is the value of a bill on St. Petersburg for 1836 roubles 10 copecks, exchange at 10d. per rouble? (1 rouble = 100 copecks.)
9. Find the relation between the French metre and the Rhenish foot; the French metre being 39 7/8 inches, and 37 English feet being equal to 36 Rhenish feet.
10. How much sugar, at 8d. per lb., must be given for 20 cwt. of tobacco, at £3 a cwt.?
11. A ton of coals costs a guinea; how many chaldrons (27 cwt.) can be bought for £50?
12. I shipped for America 70 hhds. whisky, and 22 cases Irish linen, each case containing 44 pieces; the whisky sold for 2 1/2 dollars per gal., and the linen 4 1/2 dollars per piece; how many barrels of flour, at 4 1/2 dollars per barrel, ought I to have received in return?
13. A merchant sells in Bordeaux 2500 yards English printed goods, at the rate of 4 francs for 1 1/2 yards; how many yards of French silk, at 6s. 3d. per yard, ought he to receive in exchange, exchange being at 25 fr. 50 c. for £1?
14. 80 hhds. of porter are sent to India, and sold for 50 sicca rupees per hhd.; how much sugar, at £1 15s. per cwt., can be bought with the proceeds, supposing a rupee to be equal to 2s. 6d.?
15. A dish of lead ore weighs 60 lbs., and yields, when smelted, 80

per cent. of lead, which is sold at £18 per ton; how many dishes of ore must be smelted to yield lead worth £150?

16. A block of stone, containing 60 cub. ft., weighs 16 1/2 feet to the ton; what is the value, at 5s. 6d. per cub. foot, of another block of the same weight, which weighs 14 cub. ft. to the ton?

17. A merchant sells 400 yards, which cost 15s., at a gain of 10 per cent.; how much French wine could he purchase with the money, at 10 fr. 20 c. per gallon, exchange being 25 fr. 30 c.?

18. What would paper cost, at 1s. 3d. per quire, necessary to print 500 copies of a work, in 12 volumes duodecimo, each volume containing 230 pages?

19. Find the number of grains of pure gold in a French napoleon $\frac{9}{10}$ fine, having given that 155 are coined out of 1 kilogramme (2 1/2 pounds avoirdupois).

20. If an imperial gallon contains 277 2/3 cubic inches, and 6 wine gallons are equal to 5 imperial gallons, and 59 ale gallons to 72 wine gallons, find how many cubic inches there are in an ale gallon.

21. In Bremen, 5 schwaren = 1 grothe, 72 grotes = 1 rix-dollar; if the exchange is 6 dollars 13 grotes for £1, find the value of a dollar in English money.

22. In China, 1 tael = 10 mace = 100 candareens = 1000 cash; a tael being 6s. 8d., find the equivalent of £15 7s. 6d. in Chinese currency.

23. In India, 5 tolas = 1 chittak, 16 chittak = 1 seer, 40 seers = 1 maund = 180 pounds Troy; find in avoirdupois weight the equivalent of 2 maunds 25 seers 12 chittaks 3 tolas.

24. If 11 7/5 Dutch florins are given for 25 francs, 333 florins for 437 Hamburg marks, 63 1/2 marks for 32 roubles, and 94 roubles for £15, find how many Dutch florins would be given for £1.

25. Reduce 532 thalers 25 groschen to English currency, the exchange being at 6 th. 2 1/2 gros. (1 thaler = 30 gros.).

26. Reduce £21 13s. 6d. to Prussian money, at the same rate.

27. Reduce £532 13s. 6d. to French money, at the rate of 25 francs 20 cents. for £1.

28. Reduce £93 16s. to Austrian money, the exchange being 10 silver florins 2 kreutzers for £1.

29. If Austrian silver is at 20 per cent. premium, find the equivalent of the same sum in Austrian paper.

30. If an American dollar weighs 412 1/2 grains $\frac{9}{10}$ fine, and English standard silver be $\frac{11}{16}$ fine, find the par of exchange between London and America, English standard silver being 5s. 2d. an ounce.

31. 10 grammes of French standard gold $\frac{9}{10}$ fine are worth 31 francs. Supposing an English sovereign, of which 1800 are coined out of a pound Troy, to be worth 25 1/2 francs, deduce the English weight corresponding to a kilogramme.

32. If English standard gold sells at 78s. per ounce, and another coinage is worth 72s., find the fineness of the latter.

33. Standard silver being at 5s. 2d. per ounce, and Spanish dollars being quoted at 5s. 6d. per ounce, find the fineness of the latter.

34. 1 kilogramme of standard French gold $\frac{9}{10}$ fine is coined into 155 napoleons. Into how many sovereigns could it be coined if it were $\frac{11}{16}$ fine, each napoleon being 20 francs, and £1 being equivalent to 25 francs?

35. In Prussia, 14 thalers are coined from a Cologne mark of fine silver, weighing 3609 grains; find the par of exchange between London and Berlin, English standard silver being 5s. 2d. an ounce, 1 thaler = 30 groschen, and 66 shillings being coined from a pound Troy of standard silver.

36. If 20 Austrian florins are coined from a Cologne mark of fine silver, find the par of exchange, English standard silver being 5s. 2d. an ounce.

37. If 24 1/2 florins are coined from the Cologne mark of fine silver, calculate the par of exchange at the same rate for English silver.

38. If 27 thalers are equal in value to 100 francs, and exchange between London and Berlin is 6 thalers 18 groschen, find the arbitrated rate between London and Paris.

39. 34 Hamburg marks (specie) are coined from the Cologne mark of fine silver; calculate the par of exchange between London and Hamburg. (1 mark = 16 schillings, 1 schilling = 12 pfennings.)

40. Calculate the fixed numbers in each of the five preceding questions.

41. If the exchange between London and Berlin be 6 thalers 2 1/2 groschen for £1 sterling; between Berlin and Paris 5 thalers 8 groschen for 20 francs, what is the arbitrated rate between London and Paris?

42. If the exchange between London and Paris be 25 francs 20 cents. for £1 sterling; between Paris and Amsterdam, 57 florins 20 cents. for 120 francs; between Amsterdam and Lisbon, 3 mil-reis for 8 florins; find the arbitrated rate between London and Lisbon. (100 reis = 1 mil-reis.)

43. When the exchange on Paris is 25 50 francs; between Paris and Amsterdam, 45 1/2 florins for 100 francs; and between Amsterdam and Lisbon, 320 reis for a florin; what is the arbitrated rate between London and Lisbon?

44. Given the following quotations of exchange:—
London on Amsterdam . . . 9 florins 98 cents. for £1 sterling.
" Madrid . . . 47d. for 1 dollar.
" Paris . . . 25 francs 40 cents. for £1 sterling.
Amsterdam on London . . . 9 florins 90 cents. for £1 sterling.
" Paris . . . 7 florins 75 cents. for 20 francs.

Amsterdam on Madrid.	1 florin 90 cents, for 1 dollar.
Paris on London.	25 francs 20 cents, for £1 sterling.
Madrid on Amsterdam.	5 francs 5 cents, for 1 dollar.
Amsterdam on Madrid.	7 florins 70 cents, for 20 francs.
Madrid on London.	4s. for 1 dollar.
Amsterdam on Paris.	1 florin 80 cents, for 1 dollar.
Paris on Amsterdam.	5 francs for 1 dollar.

If London has a sum to receive in Madrid, find which of the following methods will be most advantageous:—

1. Let London draw on Amsterdam, Amsterdam on Paris, and let Madrid remit to Paris.
2. Let London draw on Paris, directing Paris to draw on Amsterdam, and Madrid to remit to Amsterdam.
3. Let London draw on Madrid, and remit the bill to Paris to be negotiated; and let the returns be made in a bill on Amsterdam.
4. Let London draw on Amsterdam, Amsterdam on Paris, and Paris on Madrid.
5. Let Madrid remit to Paris, Paris to Amsterdam, and Amsterdam to London.

6. When in Paris standard gold is at 1 per mille premium, and the exchange on London is 25/30 francs, if standard gold in London be reckoned at the Mint price of £3 17s. 10½d. per ounce, find how much dearer pure gold is in Paris than in London.

LESSONS IN MUSIC. XVII.

EXAMINATION OF THE NOTES RE AND RAY.

We have now to complete our study of the "scale of all nations and all times" by examining the seventh note (RE) and the second (RAY).

1. These are the only notes of the scale which do not sound well with the key-note. They are its dissonances. It is generally confessed by teachers of singing that RAY and RE are the most difficult, "the most artificial," notes of the scale. This is especially noticeable, in uncultivated voices, on the note RE in ascending the scale, and on RAY in descending. We have mentioned the difficulties connected with these notes that the pupil may understand why they are placed last in the order of illustration. It was necessary to make him familiar with the simpler and easier notes of the scale before he advanced to any characteristic or difficult use of these two. Our pupils will also see the mistake of the ordinary methods of developing the voice, by practicing it at once on the scale of successive degrees, instead of the chord of easily recognised intervals, to which the more difficult notes may be afterwards added.

2. The note RE, when heard at length, and after the ear has been filled with the other notes of the scale, inspires the mind with a feeling of suspense accompanied with a strong desire for his resolution in the key-note. For this reason, it is generally called the "leading note"—leading the ear to the key-note. To prove this, let the pupil sing the notes of the scale either up or down, and try whether the ear can be satisfied by resting on RE.

3. The note RAY, when heard in similar circumstances, excites a feeling of suspense almost as strong as RE, but does not so decidedly indicate its resting note. The ear is pleased by its rising to the third of the scale (ME), but more satisfied by its falling on the key-note. Try the well-known Gregorian Tone with these two endings:—

Key: F# M :— m : r m :— m :—

1st ending. 2nd ending.

4. The musical effects of RE and RAY carry a strong appeal to the mind's emotions, but do not touch so directly those softer and gentler feelings which FAH and LAH affect. There is a note of hope and energy about them. RE may be called the

SENSITIVE or piercing note, and RAY the HOPEFUL or rousing note.

The touching and elegant effect of both these notes is beautifully shown in the opening of Handel's song, "What though I trace."

Key E. d | m :— f s :— s | l :— l

What though I trace each herb and

s :— s | l s : t d | r

flower, That drinks the morn-ing dew.

Another beautiful example of the effective use of RE you find in Haydn's "With verdure clad:—"

Key B♭ : s s : t t : d m : s s : t t : d :—

En-han-ced is the charm-ing sight.

But the finest examples of these mental effects you will be able to enjoy by studying Handel's song, "Angels ever bright and fair." The character of RAY preceded by LAH is shown in the opening on the word "fair:—"

s :— d :— d | t : l | s : l r r :—

An-gels e-ver bright and fair.

Then follows the soft appeal of ME, seconded by the urgency of FAH, on the words, "Take, O take me, to your care:—"

m : r f : m r : d s :— | :—

Take, O take me to your care.

This is repeated and again varied with the introduction of lower RE, thus:—

f :— s m : r d t :— d d :—

Take, O take me to your care.

And when desire has risen to the intensity almost of despair, it is expressed by the piercing voice of the higher RE, thus:—

s :— | :— t : d | m : r d d :—

Take, O take me to your care.

After several repetitions and variations of the softer theme referred to, the whole piece closes with this last piercing appeal.

5. It may easily be noticed that every simple tune is divisible into parts which correspond with a line in poetry. The notes most frequently used for the close of these phrases are DOH, ME, SOH, the resting notes of the scale. Next to these, in frequency are RAY and RE. But the more emotional notes, FAH and LAH, are but seldom found in that position. Let our pupils test this interesting fact by examining the previous

EXERCISE 29.—THE MAN'S THE GOLD FOR ALL THAT. KEY A. M. 89.

The Words by Robert Burns—Anglicised.

d :— r | d : s l : d | r : f m :— r | d : s l : s | d :— t | d : m

Is there for hon-est po-ver-ty, That hangs his head and

m :— f | m : m f : l | t : s d :— t | d : m

l :— | l : s d :— r | d : s l : d | r :— f m :— r | d : s l : s | d :— t | d : m

all that, The COW-ARD SLAVE! we pass him by, We DARE BE

f :— | f : m m :— f | m : m f : l | t :— s s :— f

d : l s :— | s : f m :— f | s : m f :— r | r : f m :— f | s : m f :— r | r : f

room, for all that; For all that, and all that, Our

m :— f | m : s d :— r | m : d r :— t | t : s

m :— f | s : s l :— | l : f m :— f | s : m m :— f | s : m m :— f | s : m

toils ob-scure, and all that; The rank is but the

d :— l | s : m f :— | f : r d :— r | m : d

l : r | r :— f m :— r | d : l s :— | s l :— | s l :— | s

gui-nea stamp, THE MAN'S THE GOLD FOR ALL THAT.

l : d | t :— s s :— f | m : f d :— | d

2. A king can make a belted knight,
A marquis, duke, and all that;
AN HONEST MAN'S ABOVE HIS MIGHT,
For kings they can't do all that.
For all that, and all that,
Their dignities, and all that,
The pith of sense and honest worth
Are better far than all that.

3. Then let us pray that come it may,
As come it will for all that,
That sense and worth o'er all the earth,
May bear the palm and all that.
FOR ALL THAT, AND ALL THAT,
IT'S COMING YET, FOR ALL THAT,
That man to man, the wide world o'er,
SHALL BROTHERS BE FOR ALL THAT.

Our Scottish friends must pardon the Anglicisms and sing the expression, or not at all. The tune illustrates the mental effects of LAH, rather than of RAY and RE.

READINGS IN FRENCH.—VI. LE VIEUX ARBRE ET LE JARDINIER.

Un jardinier dans son jardin
Avait un vieux arbre stérile;
C'était un grand poirier² qui jadis fut fertile;
Mais il avait vieilli; (a) tel est notre destin!
Le jardinier ingrat veut l'abattre un matin.
Le voilà qui prend (b) sa cognée;
Au premier coup l'arbre lui dit:
"Respecte mon grand âge, et souviens-toi (c) du fruit
Que je t'ai donné chaque année.
La mort va me saisir, je n'ai plus qu'un instant;
N'assassine pas un mourant
Qui fut ton bienfaiteur." "Je te coupe avec peine,"
Répond le jardinier; "mais j'ai besoin de bois."
Alors, gazonnait à la fois,
De rossignols une centaine
S'écrie: "Épargne-le, nous n'avons plus que lui;
Lorsque ta femme vient s'asseoir sous son ombrage,
Nous la réjouissons par notre doux ramage;
Elle est seule souvent, nous charmons son ennui." (d)
Le jardinier les chasse, et rit (e) de leur requête;
Il frappe un second coup.³ D'abeilles un essaim (f)
Sort, aussitôt du tronc,⁴ en lui disant: "Arrête;
Écoute-nous, homme inhumain:⁵
Si tu nous laisses cet asile,
Chaque jour nous te donnerons
Un miel délicieux dont tu peux (g) à la ville
Porter et vendre les rayons (h);
Cela te touche-t-il?" "J'en pleure de tendresse,"¹²
Répond l'avaré jardinier:
"Eh! que me dois-je (i) pas à ce pauvre poirier?¹³
Qui m'a nourri dans ma jeunesse?
Ma femme quelquefois vient (j) voir ces oiseaux!¹⁴
C'en est assez pour moi; qu'ils (k) chantent en repos.
Et vous qui daignerez augmenter mon aïeance,
Je veux pour vous de fleurs semer tout ce canton."¹⁵
Cela dit, il s'en (l) va¹⁶ sûr de sa récompense,
Et laisse vivre le vieux tronc.
Comptez (m) sur la reconnaissance!¹⁷
Quand l'intérêt vous en répond. FLORIAN.

COLLOQUIAL EXERCISE.

1. Qu'est-ce que le jardinier avait dans son jardin?
2. Quelle espèce d'arbre était-ce?
3. Que voulait faire le jardinier?
4. Que lui dit l'arbre au premier coup de cognée?
5. Que lui répondit le jardinier?
6. Que lui dirent les rossignols?
7. Qu'ajoutèrent-ils en parlant de sa femme?
8. Le jardinier se laissa-t-il persuader par les rossignols?
9. Que fait-il encore?
10. Qu'arriva-t-il aussitôt?
11. Que dirent les abeilles au jardinier?
12. Que leur répondit notre homme?
13. Qu'ajouta-t-il à l'égard du poirier?
14. Parla-t-il encore des oiseaux?
15. Que promit-il aux abeilles?
16. Que fit-il ensuite?
17. Comment notre ami Florian termine-t-il sa fable?

NOTES.

- (a) Vieilli, grown old.
(b) Le voilà qui prend, he seizes; from prendre.
(c) From se souvenir.
(d) Ennui, tediousness, weariness.
(e) From rire.
(f) D'abeilles un essaim. (This is a poetical inversion.)
(g) From pouvoir.
(h) Rayons, combs.
(i) From devoir.
(j) From venir.
(k) Qu'ils, let them.
(l) Va, from aller.
(m) From compter, to count, to rely upon.

UN BIENFAIT N'EST JAMAIS PERDU.

SECTION I.

TANDIS que la Louisiane faisait (a) encore partie des colonies de la France,¹ plusieurs familles françaises fondèrent des établissements dans ce beau pays.² Sur la lisière d'une vaste forêt,³ traversée par un des fleuves nombreux qui arrosent cette région, était allé s'établir un ancien négociant à qui on avait concédé (b) un vaste territoire⁴ à défricher. Possesseur de moyens assez considérables,⁵ actif, laborieux, M. Dérambert s'était bientôt vu à la tête d'un domaine fort étendu.⁶ Ces terrains, naguère encore incultes et sauvages, se couvraient (c) maintenant de riches moissons de riz, de maïs et de froment.⁷

M. Dérambert avait une femme et trois jolis enfants, deux

garçons et une fille;⁸ ces enfants faisaient leur joie, leur bonheur. Auguste avait (d) huit ans, Fanny sept, et le plus jeune, le petit Alfred, en avait quatre à peine.⁹ Tous les trois s'aimaient entre eux avec une tendresse égale; tout était commun, peines, plaisirs.

Leur promenade favorite était un petit vallon¹⁰ situé à quelques pas de la maison de leur père. Là, un châtaignier d'une grosseur prodigieuse étalait (e) son épais feuillage,¹¹ et ils pouvaient, à l'ombre que projetaient ses rameaux, se livrer à leurs jeux, sans avoir à redouter les rayons d'un soleil trop ardent.

Un jour, qu'assis (f) au pied du châtaignier, Auguste et Fanny tressaient, pour leur petit frère, des nattes¹² avec des brins de joncs qu'il allait cueillir tout joyeux, leurs oreilles furent tout à coup frappées par des hurlements plaintifs¹³ qui paraissaient (g) venir de la forêt. Bientôt après, en effet, ils aperçurent un magnifique chien de Terre-Neuve¹⁴ qui se dirigeait (h) vers eux en se traînant avec peine. Chaque fois qu'il posait à terre une de ses pattes de devant, il poussait un cri de douleur.¹⁵ Les enfants coururent (i) vers lui; le pauvre animal s'arrêta à leur approche, les regarda d'un air piteux et caressant.¹⁶ Puis tendant vers eux sa patte ensanglantée il semblait leur dire: "Secourez-moi."¹⁷

Les enfants le comprirent (j). Fanny l'attira doucement au pied du châtaignier,¹⁸ Auguste courut puiser de l'eau à la fontaine,¹⁹ tandis qu'Alfred, tenant (k) à la main un roseau, chassait les moustiques²⁰ qui venaient pour s'attacher à la plaie du blessé. Une fois tous ces préparatifs achevés, Fanny souleva doucement la patte du chien, examina son mal et aperçut une grosse épine²¹ qui s'était enfoncée (l) entre les griffes.

COLLOQUIAL EXERCISE.

1. À quelle époque cette histoire commence-t-elle?
2. Qu'avaient fait plusieurs familles françaises?
3. Où un ancien négociant s'était-il établi?
4. Que lui avait-on concédé?
5. Que possédait-il?
6. Quelle avait été la récompense de l'industrie de M. Dérambert?
7. Quels changements remarquait-on dans ces terres naguère sauvages?
8. Combien d'enfants M. Dérambert avait-il?
9. Quel était leur âge?
10. Quelle était leur promenade favorite?
11. Quel arbre y trouvait-on?
12. Que faisaient un jour, Auguste et Fanny au pied du châtaignier?
13. Qu'entendirent-ils tout à coup?
14. Qu'aperçurent-ils ensuite?
15. Que faisait le chien en posant à terre une de ses pattes de devant?
16. Que fit le chien à leur approche?
17. Que semblait-il leur dire?
18. Que fit alors Fanny?
19. Où Auguste courut-il?
20. Et Alfred, que faisait-il?
21. Que vit (m) Fanny en examinant la patte du chien?

NOTES.

- (a) From faire.
(b) Concédé, granted.
(c) From couvrir.
(d) Avait huit ans, was eight years old.
(e) Était, displayed.
(f) Assis, seated.
(g) From paraître.
(h) Se dirigeait, came.
(i) From couvrir.
(j) From comprendre.
(k) From tenir.
(l) S'était enfoncée, had penetrated.
(m) From voir.

KEY TO EXERCISES IN LESSONS IN FRENCH.

EXERCISE 124 (Vol. II., page 106).

1. Cet enfant fait-il semblant de lire?
2. Il fait semblant de lire.
3. Ce monsieur ne fait-il pas semblant de dormir?
4. Il ne fait pas semblant de dormir, il dort réellement.
5. Voulez-vous faire un tour de promenade ce matin?
6. Je le ferais avec plaisir, si j'avais le temps.
7. Avez-vous fait connaissance avec le médecin?
8. Je n'ai pas encore fait connaissance avec lui.
9. Combien de questions avez-vous faites à l'enfant?
10. Je lui ai fait beaucoup de questions.
11. Lui avez-vous demandé s'il avait étudié sa leçon?
12. Je ne le lui ai pas demandé.
13. Cette petite fille ne fera-t-elle pas son possible pour apprendre sa leçon?
14. Elle fera son possible pour l'apprendre.
15. De quelle nourriture faites-vous usage quand vous êtes malade?
16. Nous faisons usage de pain et de riz.
17. Avez-vous oublié de faire vos adieux à Mme votre mère?
18. Je ne l'avais pas oublié, j'avais l'intention d'aller chez elle cette après-midi.
19. Avec qui avez-vous fait connaissance?
20. Avec le libraire.
21. Ne faites-vous pas attendre ces dames?
22. Je ne les fais pas attendre, elles ne sont pas prêtes.
23. Est-ce que je vous fais attendre?
24. Vous ne me faites pas attendre.
25. Avez-vous laissé vos enfants dans votre chambre?
26. Je ne l'ai pas fait.
27. Les avez-vous fait sortir?
28. Je ne les

ai pas fait sortir, je les ai laissés où ils étaient.

29. Avez-vous fait des emplettes ce matin?

30. Je n'en ai pas fait, je n'ai pas d'argent.

31. Le domestique a-t-il fait du feu dans ma chambre?

32. Il en a fait.

33. Ferez-vous votre possible pour venir demain?

34. Je ferai mon possible pour venir de bonne heure.

35. Nous fimes hier quarante lieues en seize heures.

EXERCISE 125 (Vol. II., page 106).

1. Why does that workman pretend to be sick?
2. He pretends to be sick because he has no wish to work.
3. Does not that student play the learned man?
4. He does not play the learned man, he plays the fool.
5. Does it become that young man to play the master here?
6. It becomes nobody to play the impertinent.
7. Does that matter?
8. That is of no consequence whatever.
9. Can that concern those vine-dressers?
10. That does not concern them at all.
11. Are you not very much grieved (vexed) at that?
12. We are very sorry for it, but we cannot help it.
13. Has not your partner become a jeweller?
14. No, Sir, he has turned painter.
15. Has not that mechanic turned glazier?
16. He has become a tanner, and his brother has become a soldier.
17. Has not the milliner had her hair cut?
18. She has had it cut.
19. Do you not rise as soon as it is daylight?
20. Yes, Sir, I rise very early.
21. Is it not moonlight?
22. It is very light, but it is not moonlight.
23. Is the living good in America?
24. The living is good in America, provisions (there) are cheap.

EXERCISE 126 (Vol. II., page 106).

1. Ce monsieur ne fait-il pas le savant?
2. Il fait le seigneur et le fou à la fois.
3. Ce garçon ne fait-il pas le malade?
4. Il fait le malade, il n'a pas envie d'étudier ses leçons.
5. Quand vous n'avez pas envie de travailler, faites-vous le malade?
6. Je ne fais jamais le malade.
7. Fait-il de la bone aujourd'hui?
8. Il ne fait pas de boue, il fait de la poussière.
9. Fera-t-il clair de lune ce soir?
10. Il ne fera pas clair de lune, il fera très obscur.
11. Fait-il bon ici?
12. Il y fait très bon.
13. Fait-il trop chaud ou trop froid?
14. Il ne fait ici ni trop chaud ni trop froid.
15. Vous ferez-vous couper les cheveux?
16. Je me suis fait couper les cheveux hier matin.
17. Ne voulez-vous pas aller à la maison? il commence à se faire tard.
18. Ne fait-il pas très obscur dehors?
19. Il ne fait pas obscur, il fait clair de lune.
20. Le vitrier ne s'est-il pas fait orfèvre?
21. Il ne s'est pas fait orfèvre, il s'est fait soldat.
22. Cela fait-il quelque chose à M. votre frère?
23. Cela ne lui fait rien.
24. N'êtes-vous pas fâché de cela?
25. J'en suis fâché, mais je ne puis qu'y faire.
26. Pourquoi vous faites-vous raser?
27. Parce que je ne puis me raser moi-même.
28. N'avez-vous pas fait mal à ces enfants?
29. Je ne leur ai pas fait mal.
30. Vous êtes-vous fait mal au bras?
31. Non, Monsieur, mais je me suis fait mal à la tête.
32. Mlle votre sœur ne s'est-elle pas fait mal à la main?
33. Elle s'est fait mal à la main, et ma mère s'est fait mal au coude.
34. Ne vous êtes-vous pas fait mal à la tête?
35. Je ne me suis pas fait mal à la tête, mais je me suis fait mal à la main.

GREAT BOOKS.

XX.—GOETHE'S "FAUST."

Few legends have had a greater and wider popularity than that of Dr. Faustus, the wicked magician, who, for a few years of unrestrained indulgence, bartered his soul to the Prince of Darkness. The story is of German origin, and appears to have sprung up towards the latter end of the sixteenth century. By some writers, the legendary Faustus has been identified with the celebrated inventor of printing, and this is probably the usual impression; but the misconception arose in comparatively modern times. Nevertheless, there is a real personality at the back of this imaginary figure. Faust was a friend of Paracelsus and Cornelius Agrippa, and is mentioned by Melancthon, Luther, and other writers of the same period, as a learned man and scientific inquirer. In those days of general ignorance, such men were often regarded as necromancers and dealers in unholy lore; and it would seem that Faust, so far from participating in the religious zeal awakened by the Reformation, allowed himself a certain freedom in the discussion of theological dogmas, which shocked the more strictly disposed. A story based on the supposed life of the sorcerer was published in Germany in 1587, and a ballad on the same subject appeared in England in the following year. The fiction became popular at once, and something like a Faustian literature speedily arose. The old English tale of "Dr. Faustus" is a wild and extravagant fiction, compounded of supernatural adventure, picturesque description, scholastic learning, and ribald buffoonery; sometimes really poetic and impressive, at others mean, vulgar, and foolish to the last degree. The date of its publication is uncertain, but it could not have been long after the issue of the

German work already mentioned. It doubtless furnished to the old English dramatist, Christopher Marlowe, his play on the same subject, which was first acted in 1589 or 1590: a very unequal and ill-ordered production, often flat and worthless, but occasionally revealing a depth and intensity of passion which Shakespeare could hardly have surpassed. In our own days, we have had two musical productions by celebrated composers on this attractive subject; and Retzsch, the German artist, has familiarised us with the figures of Faust and Mephistopheles, of Margaret and Valentine, and with the other characters of the wondrous story.

But undoubtedly the chief modern creator of the character of Faust is Goethe, of whose great drama Retzsch's designs are the fitting illustrations, and the works of Gounod and Berlioz are the lyrical exponents. The First Part of Goethe's principal work was published in 1806, and the conclusion did not appear until a later date; but the subject had engaged the author's attention for many years, and some portions were written as early as 1774 and 1775. The various scenes were remodelled in 1797, and the poem, as it now stands, was completed in 1801. The "Faust" of Goethe is the old mediæval legend, interpreted in a philosophising spirit that is altogether modern. Marlowe had painted his hero after a coarse and easily-apprehended fashion. Faustus, as presented by him, is simply a student who, weary with the ordinary results of knowledge, sells himself to the Tempter for worldly riches, for the gratification of sensual desires, and for the pride of exalting his power, by extraordinary arts, above all the potentates of the world. Many of his actions consist of the most ridiculous practical jokes, such as any conjuror at a fair could perform; and from these he passes to the enjoyments of a commonplace debauchee. In the conception of Goethe, Faust is a far higher being. He is a man tormented with a consuming desire for absolute knowledge—with the ambition of raising himself to the level, and the nature of a god. It is only when he has discovered the vanity of Knowledge that he enters into a compact with Mephistopheles for the obtaining of Happiness. But the pursuit of happiness for its own sake, and as the sole object of life, is always demoralising, and Faust soon enters on a career of vice. The general course of the story—the sorrows of Margaret, the slaughter of Valentine, and the other incidents of the drama—need not be here related. These things are incapable of summary treatment, and depend for their power on the peculiar art with which the poet has unfolded and illustrated the leading ideas by which his mind was possessed.

This extraordinary work was not long in producing its effect in Germany. It seized at once on the popular mind and on the higher intellect, and no poem has been made the subject of a larger amount of comment, except the "Divina Commedia" of Dante. Touching on the character of Mephistopheles, Thomas Carlyle has said that he "comes before us, not arrayed in the terrors of Coeysus and Phlegethon, but with natural, indelible deformity of wickedness. He is the Devil, not of superstition, but of knowledge. Such a combination of perfect understanding with perfect selfishness, of logical life with moral death, so universal a denier both in heart and head, is undoubtedly a child of Darkness, an emissary of the primeval Nothing, and may stand, in his merely spiritual deformity, at once potent, dangerous, and contemptible, as the best and only genuine Devil of these latter times." This combination of knowledge with selfishness, of intellectual power with a disregard of moral responsibility, of boundless curiosity with defective conscience, is indeed one of the least encouraging symptoms of our age; and Goethe has anticipated it in the character of Mephistopheles. The Tempter in "Faust" is a being absolutely perfect in his badness. He has no hesitation, no revulsion of feeling, no remorse, no sorrow for the better life which he denies and outrages, no aspiration except towards limitless evil, no despair of any higher ends. Yet some critics have doubted the propriety of this conception. Hallam has observed that "there is an awful melancholy about Marlowe's Mephistopheles, perhaps more expressive than the malignant mirth of that fiend in the renowned work of Goethe;" and Charles Lamb (whose intensely English feeling, however, put him out of sympathy with most foreign productions) regarded the German poem as a mere vulgar melodrama in comparison with the Elizabethan play. The determination of this point

must rest very much with the individual reader's conception of the diabolical nature.

The next important character to Faust himself and Mephistopheles is Margaret, or Gretchen, as she is sometimes called. Of this peasant-girl, the late Mr. G. H. Lewes, the English biographer of Goethe, has remarked that "Shakespeare himself has drawn no such portrait; no such peculiar union of passion, simplicity, homeliness, and witchery."

The moral character of Goethe's drama will always be a subject of dispute. Some regard it as containing the noblest lessons; others bring against it the charges of irreverence, scepticism, and laxity. What may most truly be affirmed is, that it is a vast and varied picture of human life, reaching upwards into the heavens, and downwards into the infernal depths.

MECHANICS.—VI.

FINDING CENTRES OF GRAVITY.

In the last lesson it was shown that every mass of matter has a centre of gravity, but we did not inquire how such centres are found in bodies of known shapes. To that part of our subject we now proceed.

As a general rule, the problem requires high mathematics for its solution; but there are some cases in which the centre can be discovered without much difficulty. I take, first, the practical method by *suspension*, which gives it exactly whenever the body is of a uniform thickness, such as a deal board, or card, or piece of paper. The two opposite faces should be equal and alike, the edges being either perpendicular or square to them, or running off at the same slope. In all such cases it is evident that the centre of gravity is within the substance of the board half-way across between the faces. If, therefore, we can find the point on either face under which it lies, by boring straight in half-way at that point, the required centre is reached.

But how find the outside point? Let the board be of any irregular shape, as at *a* (Fig. 27), and bore two holes through it

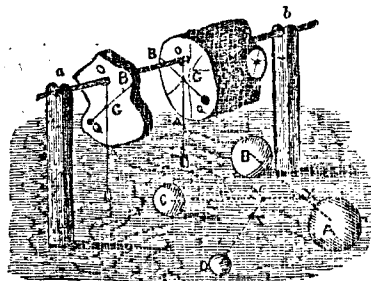


Fig. 27.

perpendicularly at any two points, near its edge, *o* and *q*. Put a straight iron rod now through *o*, and on the rod, by a small ring, hang a plumb line, *o* *A*, close to the board. Put rod, line, and board now across two supports, so arranged that the rod may be horizontal. The board having settled to rest, the

centre of gravity will, as I showed in the last lesson, be somewhere behind the plumb-line. Chalk now, or mark with a pencil, the course, *o* *A*, of this line on the board. Perform the same operation with the hole *q*, pencilling in like manner the line *q* *B*. What now have we? Two lines, behind both of which the centre of gravity lies; whence we infer that their intersection, *g*, is the point required.

But the method in part applies to bodies which have not parallel faces like boards, or are not cut perpendicularly, or at the same slope across at their edges; but in such cases the sought centre is *not midway across*. All that is necessary is that there should be *one flat face* on it, as in that represented at *b* (Fig. 27). You can still determine the point *g*, behind which the centre of gravity lies, by boring two passages at *o* and *q*, perpendicularly to the face, into its substance, suspending and marking the lines *o* *A*, *q* *B*, as before. The centre of gravity will still be behind the point *g*; but where, or how far in, is another question, the answer to which depends on the *shape* of the body.

If the board which above first occupied our attention be supposed to become very thin—to be cardboard, or even paper—the body becomes *almost all surface*, and the point *g* and the centre of gravity nearly coincide. Practically, they become

identical; and the operation is sometimes spoken of as "the finding of the centre of gravity of an *area* or *surface*." In strictness, a *surface* cannot have a centre of gravity, for (see Lesson I. on Geometry) it has *no thickness*, and therefore can have *no weight*, no force, no centre of force. But, for all that, the inquiry is useful. We may agree, for *mechanical purposes*, that a *surface* should have such a centre; and the best course for that purpose is to give it a thickness the smallest we can conceive, namely, that of one particle or atom. Imagine, then, a triangle, or polygon, or circle, *one atom thick*; and let us agree that, when we find its centre of gravity, we have the centre of gravity of an "area" or "surface." Also let it be understood that the centre of gravity of a line, straight or curved, means that point for such a line of atoms.

TO FIND CENTRES OF GRAVITY BY CONSTRUCTION.

This is done by the rule for finding the centre of parallel forces, given in Lesson IV. (page 125). We shall commence with the most general case, namely:—

1. To find the common Centre of Gravity of any number of Bodies, the separate Centres and Weights of which are given.—The masses may be anyhow placed, but the operation is the same whether they are all on the same plane, as in the case of the balls on the ground, in Fig. 27, or whether some are in that plane, some above, and some below. Let them be four in number and on the same plane, their centres being *A*, *B*, *C*, *D*; then four parallel forces, the weights, act at these centres: what has to be done? Join first *A* with *B*, and cut the joining line at *x* inversely as the weights at these points. Next connect *x* and *C*, and cut *Cx* at *y* inversely as the two first weights to that at *C*. Lastly, *y* being joined to *D*, divide *Dy* at *z* inversely, as the weights of the three balls already used are to that of the fourth, *D*. This last point, *z*, is the required common centre of gravity.

You observe that the joining and cutting of the lines is in no way influenced by, or dependent on, the bodies being on the same or in different planes, neither is it dependent upon their number. How many soever they be, the operation is the same. Note, also, that a common centre of gravity can be outside the bodies of which it is the centre.

2. To find the Centre of Gravity of a Right Line.—A mechanical right line being, as we have agreed, a line of atoms of equal size and weight, the case is that which we have considered in Lesson IV., of a number of equal parallel forces acting at equal distances from each other, along a right line. The resultant passes through the middle point of that line; hence the centre of gravity of a right line is its middle point.

This enables us to find the centre of gravity of a uniform rod. By "uniform," I mean such that the cross sections are of the same size and form throughout its length. Such a body may be considered a collection of equal mechanical right lines placed side by side, their ends being made flat or level. As the centre of each line is in its middle, the centre of the whole bundle is in the cross section at the rod's middle. And observe that this holds good of all other bodies, besides mere rods, which can be considered made up of equal parallel lines, such as of a cylinder or uniform pillar, or of a beam of timber, or of a cubical block of stone; the centres of gravity will be in the cross sections at their middle points. And it makes no difference whether the flat ends of the cylinder, pillar, beam, or block are perpendicular to the lines of which it is supposed to be composed, as in *c* and *e* (Fig. 28), or oblique to them, as at *d* and *f* (Fig. 29); the centre of gravity is still in the middle cross section parallel to

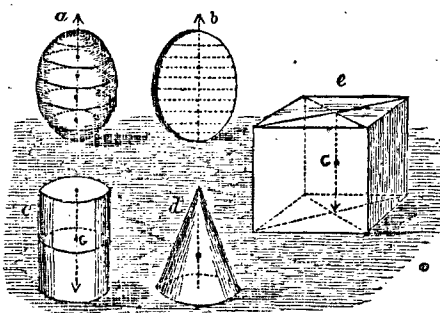


Fig. 28.

BD is the bisector of the common side *AC* of both the triangles, *ABC* and *ACD*. The centre of each, therefore, is on that line, and therefore the common centre of both—that is, the centre of the parallelogram. But, by the same reason, considering the parallelogram made of the two triangles on *BD*, the centre is on *AC*. Being thus on both diagonals, it is at their intersection.

the flat ends. Moreover, as all bodies so shaped may be considered a collection of areas, one atom thick, piled on top of each other, either perpendicularly or with a slope, like cards, or a pile of sovereigns, the centre of gravity of each must lie also on the line joining the centres of gravity of the two areas which form their ends. The centre itself, therefore, is the point in which this line pierces the middle cross section, as at *c* and *e* (Fig. 28), in the cylinder and cube. But this requires us to be able to find the centre of gravity of such areas, of which take first the triangle.

3. To find the Centre of Gravity of a Triangle.—This we do by considering the triangle made up, as in the triangle *a*, in Fig. 30, of lines an atom thick, all parallel to the side *AB*. The centre of gravity of each line is at its middle point. If, therefore, I can satisfy you that the middles of all the lines are on the line *CM*, which joins the vertex *C* with the middle *M* of *AB*, the centre for the whole triangle is somewhere on that line.

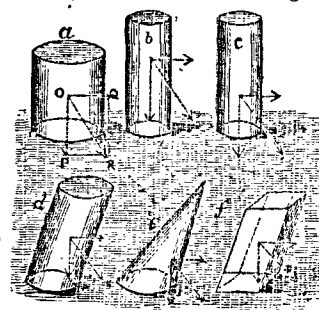


Fig. 29.

I have, then, to prove that *CM* bisects, or divides into two equal parts, every line parallel to *AB*. Suppose, now, that I cut *C* *M* into three equal parts, *Cx*, *xy*, *ym*, as in the triangle *b*, in Fig. 30, and draw parallels to *AB* at the two points of section inside, meeting *A* *C* and *B* *C* each in two points from which parallels to *CM* are drawn, meeting *AB* in four points, two on each side of *M*. Now, since *C* *M* is equally divided, and the white figures inside are parallelograms, it is evident that the line parallel to *C* *M* marked *a*, *b*, on each side, are equal to each other, and to *Cx*, the third part of *C* *M*. Hence the three small shaded triangles next to *A* are equal to each other, and have equal angles. Their three sides parallel to *AB* are therefore equal, which shows that *A* *M* is cut by the parallels to *CM* into three equal parts. For the same reason *B* *M* is cut into three equal parts; and since *A* *M* is equal to *B* *M*, the six parts into which *AB* is divided are equal to each other. You thus see that the first parallel above *AB* is made of parts, two on either side of *C* *M*, equal to the parts below, and is therefore bisected by *C* *M*. The next above is also evidently bisected, being composed of two parts, one on either side. Now, if I divide *C* *M* into five parts instead of three, I have four other parallels also bisected by *C* *M*; if into 7 or any other number, it is the same—I can fill the whole triangle with parallels to *AB* bisected each by the line *C* *M*. The centre of gravity of the triangle is therefore on *C* *M*.

But by a similar reasoning it can be shown that this centre of gravity must be in *AL* (in triangle *a*, Fig. 30) bisecting *AC*. Hence we have for rule that, in order to find the centre of gravity of a triangle, we must join any two of its vertices with the middle points of the sides opposite to them, and that the intersection *g* of the joining lines is the required point.

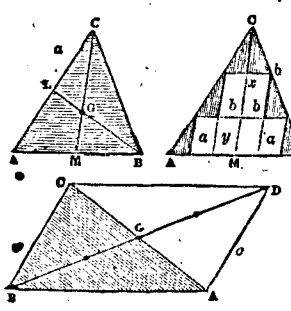


Fig. 30.

The centre of gravity of a parallelogram can now be shown to be the intersection of its diagonals *AC*, *BD* (see *c*, Fig. 30); for, since the diagonals bisect each other, the line

4. To find the Centre of Gravity of a Polygon.—Let *ABCDE* (Fig. 31) be the polygon, and from the angle *A* draw the dotted lines *AC*, *AD* to the remote angles *C* and *D*. The polygon is thus cut up into three triangles. Let *g*, *h*, and *k* be the centres of gravity of these latter figures; there are thus three bodies—whose centres, *g*, *h*, and *k*, are known, and whose masses are the three areas of the three triangles.

Suppose now that you had calculated these areas, and had them written down in numbers. Then join *g* with *h* and cut *gh* at *x* inversely as the numbers expressing the areas of the triangles *ABC*, *ADC*. Connect *x* now with *k*, and cut *xk* at *y* inversely, as the quadrilateral *ABCD* to the triangle *AED*; the point *y* is the required centre. If the polygon had more sides than are in Fig. 31, the process is the same, and must be continued until all the triangles into which it is necessary to divide the polygon have been gone over.

5. To find the Centre of Gravity of the Circumference of a Circle.—Let the circumference be taken to be a curved line of atoms, as in *a*, in Fig. 32, to the right; and through the centre *g* of the circle let any line, *AGB*, be drawn passing through two of them, one on either side. Since these two are of equal weight, and equally distant from *g*, their common centre of gravity is the middle of *AB*, that is, the point *g*. So, likewise, going round the figure, the centre of gravity of every opposite pair of atoms is *g*, and therefore *g* is the common centre of all, or of the circumference.

The centre of gravity of a ring is thus seen to be the centre of the circle in which it is formed, for the ring may be considered a bundle of circles an atom thick, bound together, one above and around the other, so as to have for common centre of gravity the centre of the central circle.

The centre of gravity of the area of a circle is also the centre of figure of the circle, for the area may be considered as made up of a number of circles of atoms, lying one inside the other, and having the same centre, *g*, which, by the above, is therefore their common centre of gravity.

The centre of gravity of a hollow sphere may, in like manner, be proved, by drawing lines through *g* to the atoms on its surface, to be the centre of figure of the sphere; and a solid sphere may be considered as consisting of a number of these hollow ones inside one another.

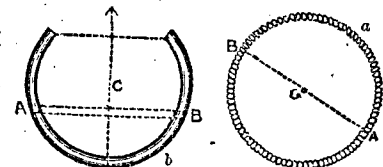


Fig. 32.

ANSWERS TO THE QUESTIONS IN LESSON IV.

Parallel Forces.

1. The required parallel centre in this case is on the line joining any vertex of the triangle with the middle point of the side opposite, at a distance of two-thirds of that line from the vertex, or one-third from the side.
2. The required centre is distant one-third of the length of the beam from the end at which the three-pound force acts.
3. The required centre is 8 inches distant from the end of the rod at which the three-and-a-half pound weight acts.
4. The strain on the upper hinge is 20 lbs. 3 oz. nearly, and on the lower 39 lbs. 13 oz. In doing this question the student must first find the centre of parallel forces for the 23 lbs. and 37 lbs. This point will be found by cutting the 7 feet of height of door into 60 parts (the sum of 23 and 37), and counting off 23 of these from the bottom. The resultant then acts at the end of the 23rd subdivision. But as the hinges bear the drag of this force, it is divided between them in the inverse proportion of their distances from this point. Divide then the 60 lbs. into two parts, which have this proportion, and the above strains will be found. It is better to do this question by arithmetically calculating the position of the point and magnitudes of strains. The strain caused by the weight of the door is not here taken into consideration.

LESSONS IN ITALIAN.—V.

IV.—THE DIPHTHONGS.

I HAVE now to speak of the diphthongs; but before entering into details I may remark that these letters differ materially from the English, inasmuch as the two vowels forming a diphthong do not entirely merge into one sound, but are in Italian more or less distinctly heard, though only pronounced by one opening of the mouth, and with one emission of the air or voice, which gives them the value of one sound. This broad and general characteristic, however, prevails among all Italian diphthongs, that there must be a ruling sound, requiring a greater stress of the voice and more distinctness of utterance, which ruling sound is at one time on the first, at another on the second of the two vowels. In those diphthongs where the second of the two vowels is the ruling sound, the voice glides more rapidly from the first vowel to the second, and is, as it were, absorbed by it. The second is on that account heard with greater distinctness, and such diphthongs present more of a united sound; while in those diphthongs where the first of the two vowels is the ruling sound, the second is somewhat more distinctly heard than the first vowel of those diphthongs, which approach to a united sound, though shortly and quickly trailed along, as it were, by the first.

The second kind or class may be termed, on this account, the separated diphthongs; the first class the united diphthongs—though I must caution the reader not to understand those words in their strictly literal sense; because, as stated before, in all Italian diphthongs the two vowels are more or less distinctly heard.

United diphthongs are, for example:—

- ia*, as in *fiato* (fee-ah-to), breath; *biada* (bee-ah-dah), corn; *pieno* (pee-ah-no), even, slow.
- ie*, as in *lieto* (lee-oh-to), cheerful; *bieco* (bee-oh-ko), squinting; *priego* (pre-oh-go), request, prayer.
- io*, as in *fiore* (fee-oh-rah), flower; *piove* (pee-oh-vai), it rains; *briso* (bree-oh-so), lively; *chioma* (kee-oh-mah), head of hair.
- iu*, as in *più* (pee-oh), more; *fiume* (fee-oh-mai), a river; *schiuma* (ske-oh-mah), foam, scum.
- ua*, as in *guasto* (gwah-sto), destruction; *quà* (kwah), here, hither; *quale* (kwah-lai), who.
- ue*, as in *guerra* (gwerr-rah), war; *Guelfo* (gwel-fo), a Guelph; *questo* (kwai-sto), this.
- ui*, as in *guisa* (gwée-zah), guise, manner; *Guido* (gwée-do), Guy; *qui* (kwee), here.
- uo*, as in *cuore* (koo-oh-rah), heart; *suono* (soo-oh-no), sound; *uomo* (oo-oh-mo), man.

Separated diphthongs are, for example:—

- ae*, as in *aere* (ahai-rah), air, gas; *aerimante* (ahai-reo-mahn-tai), one who predicts by the air, or by aeromancy.
- ai*, as in *laido* (lah-ee-do), ugly; *maisi* (mah-see-sée), yes, indeed.
- ao*, as in *Paolo* (pah-oh-lo), Paul.
- au*, as in *aura* (ahoo-rah), a soft breeze; *lauro* (lahoo-ro), laurel; *fraude* (frá-hoo-dai), deceit; *fauvo* (fá-hoo-no), fawn; *causa* (ká-hoo-zah), a cause (at law), affair.

I have classed *au* as a separated diphthong where the first vowel is the ruling sound. There are, however, words containing that diphthong, in which *u*, the second, is the ruling sound: thus, *paura* (pah-oo-rah), fear; *baule* (bah-oo-lai), portmanteau; *Saule* (sah-oo-lai), Saul. But even in this class of words *a* and *u* must be distinctly heard; *a*, as the first of the vowels, cannot be glided over rapidly and absorbed by the *u*, as would be the case if a united diphthong. The diphthong *au* must, therefore, always be classed among the separated diphthongs.

eo, as in *Eolo* (é-oh-lo), Eolus.

eu, as in *Europa* (ai-oo-ró-pah), Europe; *feudo* (fé-oo-do), a feud or fief; *Seleuco* (sai-lé-oo-ko), Seleucus.

The vowel *i* before any other vowel, and the vowel *u* before *o*, as they occur in the united diphthongs, make in the pronunciation of Italian precisely the same impression as a grave or diatonic note in music, slightly but distinctly touched, to glide over to the second ruling vowel. They are very easy transitions, and carry with them a particular charm, giving to the sound a certain roundness and fullness, thus contributing greatly, by the frequency of the diphthongs in which they occur, to the musical character of the Italian tongue.

It must be noted that there are vowels which come together

in words, but are, nevertheless, not diphthongs; as, for example, *coagulare* (ko-ah-goo-lah-rah), to coagulate; *coerente* (ko-ai-rén-tai), coherent; *caos* (ká-oh-s), chaos; *coincidere* (ko-in-tché-dai-rah), coincide; *raunare* (rah-oo-nah-rah), to assemble; *aempiere* (ah-ém-pee-rah), to satisfy, fill; *reale* (rai-ah-lai), royal, real, loyal; *rimuovere* (ree-oo-née-rah), to remove; *viola* (vé-oh-lah), he violates; *vittolo* (vee-ót-to-lo), narrow passage or way, roundabout way; *Dione* (dee-oh-nai), Dion; *Tiziano* (tee-tsee-ah-no), Titian; *Teodoro* (tai-oh-dó-ro), Theodore; *riesco* (rée-é-sko), I succeed; *reato* (rai-ah-to), guilt or sin; *paese* (pah-ái-zai), country; *reina* (rai-é-nah), queen; *leone* (lai-ó-nai), lion; *mansueto* (mahn-soo-é-to), tame, gentle, mild.

The reader will have remarked that I have, in the above examples, separated the two vowels which come together into syllables, thereby showing that they are not diphthongs, though they may appear to be such. Indeed, if those sounds were diphthongs, it is obvious that they could not be used as separate syllables, as they must in Italian spelling, though the poets, by their special licence, generally use them as one syllable.

Some grammarians are of opinion that in cases of the coalition of three and sometimes four vowels in the Italian language, those vowels form one syllable uttered with one and the same emission of the voice; and they term the coalition of three vowels a triphthong, and the coalition of four a quadrithphong, if I may so express it. They have been, perhaps, led into that belief by the example of the poets, who in the middle of a verse use the triphthongs like one syllable. It is certainly allowable for Italian poets to count two or three syllables, being mere vowels, as one; but it would be strange to found grammar on poetical licences, which are, strictly speaking, exceptions to grammatical rule. The following examples, generally cited as triphthongs, are spelt like words of two syllables, though, as I have already observed, the poets use them in the middle of a verse like words of one syllable; and this is reason enough why they should not be considered triphthongs, i.e., coalitions of three vowels forming one sound and one syllable; as, *miel* (mee-é-ee), my (pl.); *tuoi* (too-é-ee), thy (pl.); *suoi* (soo-é-ee), his (pl.); *guai* (gwah-ee), wailings; *bucio* (bood-ee), oxen; *vuoi* (voo-é-ee), thou wilt; *puoi* (poo-é-ee), thou canst; *appiolo* (ahp-pee-oo-é-lo), a kind of apple tree; *cedriolo* (tchai-dree-oo-é-lo), a cucumber; *maruolo* (mah-ree-oo-é-lo), a sharper; *vetriolo* (vai-tree-oo-é-lo), vitriol.

Examples of the so-called quadrithphongs will be given and commented on as they occur.

THIRD PRONOUNCING TABLE.

Showing Words with Vowels in Coalition.

1. Words the same with regard to their letters, but different with regard to their syllables:—

Italian.	Pronounced.	English.
<i>Balka</i>	báh-leeah	Nurse.
<i>Balia</i>	bah-lée-ah	Power, dominion.
<i>Balio</i>	báh-leo	A tutor, foster-father.
<i>Ballo</i>	bah-lée-o	Bailiff, steward, president.
<i>Bacio</i>	báh-toh*	A kiss, I kiss.
<i>Bacio</i>	bah-tché-o	A northern aspect.
<i>Bugia</i>	bóo-jah	He bores a hole, he lies.
<i>Bugia</i>	boo-jée-ah	A lie.
<i>Empia</i>	ém-pee-ah	Impious.
<i>Empia</i> (for <i>empiva</i>)	em-pee-ah	He filled.
<i>Liscia</i>	lee-shée-ah	A polished stone.
<i>Liscia</i>	lée-shah	Smooth, sleek.
<i>Viola</i>	vee-oh-lah	Violent.
<i>Viola</i>	vée-o-lah	He violates.

2. Words nearly the same as respects letters, but different with regard to syllables:—

<i>Sofia</i>	sóf-feeah	He blows.
<i>Sofia</i>	so-fée-ah	Sophia, a woman's name.
<i>Maligno</i>	mahl-váh-jo	Wicked.
<i>Maligno</i>	mahl-vah-gée-ah	Malmsey wine.
<i>Primizia</i>	pre-nee-tsee-ah	Firstlings of fruit or animals in sacrifice.
<i>Primizia</i>	pre-mah-tsée-ah	Primacy.
<i>Erbaria</i>	er-bah-rée-ah	Vegetable market.
<i>Erbario</i>	er-báh-reo	Herbal.

* For the sake of adhering to system, I am obliged here to anticipate the use of some combinations I have not yet explained, but which will be fully explained in the next lesson; as, for example, *cio*, *gio*, *scio*, etc.

3. General exercises in diphthongs:—

<i>Aere</i>	ahai-rah	Air, gas.
<i>Paese</i>	pah-ái-zai	Country.
<i>Laido</i>	lah-ee-do	Ugly.
<i>Caino</i>	kah-é-no	Cain.
<i>Traino</i>	tráh-é-no	The trot of horses.
<i>Traino</i>	trah-é-no	Sledge.
<i>Linea</i>	lée-nai-ah	A line.
<i>Idea</i>	ee-dé-ah	Idea.
<i>Idee</i>	ee-dé-ai	Ideas.
<i>Linee</i>	lée-naiai	Lines.
<i>Sei</i>	sé-ee	Six.
<i>Omei</i>	o-mé-ee	Woes, sorrows.
<i>Leone</i>	lai-ó-nai	Lion.
<i>Euro</i>	é-oo-ro	East wind.
<i>Creusa</i>	krai-óo-zah	Creusa, a woman's name.
<i>Biada</i>	bee-ah-dah	Corn.
<i>Diana</i>	dee-ah-nah	Diana.
<i>Cielo</i>	tché-lo	Heaven, horizon, the air.
<i>Lieto</i>	lee-é-to	Cheerful.
<i>Paolo</i>	pá-oh-lo	Paul.
<i>Fauvo</i>	fá-hoo-no	Fawn.
<i>Paura</i>	pah-óo-rah	Fear.

I have stated that *au* is, strictly speaking, a diphthong; but principally in those words where the accent of tone falls on the second of the vowels that compose it. It makes in its pronunciation the impression as if it were no diphthong at all, because each of the vowels is distinctly separated in pronunciation. On that account, I have ventured to place it amongst these words, with vowels in coalition, that are not diphthongs.

<i>Giove</i>	jó-vai	Jove, Jupiter.
<i>Dio</i>	dé-o	God.
<i>Giuda</i>	jó-dah	Judas.
<i>Lute</i>	lee-óo-to	Lute.
<i>Oio</i>	óo-bó	Die!
<i>Annoi</i>	ahn-nó-ee	Thou annoyest.
<i>Quasi</i>	kwh-ze	Almost, as it were.
<i>Dualo</i>	doo-ah-lai	Dual.
<i>Quete</i>	kwé-to	Quiet, calm.
<i>Duello</i>	doo-él-ló	Duel, fray.
<i>Fluido</i>	floo-ee-do	Fluid.
<i>Luigi</i>	loo-é-jee	Lewis.
<i>Luogo</i>	loo-ó-go	Space, spot, locality.

FOURTH PRONOUNCING TABLE.

For Additional Exercise in the Vowels.

1. Words that contain *a*, *e*, *i*, *o*, or repeated *u*:—

Italian.	Pronounced.	English.
<i>Calafata</i>	kah-lah-fah-tá-tah	Calked.
<i>Abbacinata</i>	ahb-bah-tché-nah-tah	Dazzled.
<i>Accanalata</i>	ahk-kah-nah-láh-tah	Channelled (column).
<i>Salamandra</i>	sah-lah-máhn-drah	Salamander.
<i>Abbracciata</i>	ahb-bráh-tcháh-vah	I knitted.
<i>Cavalanza</i>	kah-vahl-káh-vah	I rode.
<i>Perseverata</i>	per-sei-vai-rai-rái-tai	You will persevere.
<i>Dependentemente</i>	dai-pen-den-tai-mén-tai	Dependently.
<i>Preterderate</i>	prai-ten-dai-rái-tai	You will preterend.
<i>Eccellentemente</i>	et-tché-len-tai-mén-tai	Excellently.
<i>Inspidissimamente</i>	in-see-pee-dis-see-mee	Most insipid.
<i>Vicinissimamente</i>	vee-tché-nis-see-mee	Very near or vicinal.
<i>Intimissimamente</i>	ee-nee-mee-tchis-see-mee	Very hostile or inimical.
<i>Mirificamente</i>	mee-rée-fee-tché	Wonderful, miraculous.
<i>Distintissimamente</i>	dee-stin-tis-see-mee	Very clear or distinct.
<i>Difficilissimamente</i>	diff-fee-tché-lis-see-mee	Very difficult.
<i>Odoroso</i>	o-dó-ró-so	Fragrant, odorous.
<i>Doloroso</i>	dó-lo-ró-so	Painful, dolorous.
<i>Pomocotigno*</i>	po-mo-ko-tín-nyo	Quince.
<i>Tumultuo</i>	too-móol-too-o	I excite a tumult.
<i>Usufruttuo</i>	oo-zoo-tróot-too-o	I have temporary use of.

2. Words comprising five vowels:—

<i>Affettuosi</i>	ahf-fet-too-ó-si	Kind, affectionate.
<i>Comunicare</i>	kom-moo-nee-káh-rah	To communicate.
<i>Delicatuzzo</i>	dai-lee-kah-tó-zo	Over-refined, delicate.
<i>Entusiasmo</i>	en-too-zee-ah-zoo	Enthusiasm.
<i>Fulminatore</i>	fool-mee-nah-tó-rah	One who fulminates.
<i>Lusingheranno</i>	loo-zin-gai-ráhn-no	They will flatter.
<i>Procuratrice</i>	pro-koo-rah-trée-tchah	A solicitor's wife.
<i>Republicano</i>	rai-poo-blee-káh-no	Republican.
<i>Saluberrimo</i>	sah-loo-bérr-ree-mo	Very wholesome.
<i>Speculatore</i>	spai-keo-lah-tó-roo	Thinkers, speculators.
<i>Subordinato</i>	soo-bor-dee-náh-rah	To subordinate.
<i>Superlativo</i>	soo-per-lah-té-vo	Highest, superlative.

* The sound of the *g* will be explained in another lesson.

GEOMETRICAL PERSPECTIVE.—VIII.

PROBLEM XXIV. (Fig. 45).—Draw the perspective view of a flight of three steps, each 4 feet long, 1 foot wide, and 9 inches high; their front making an angle of 40° with the picture plane. The distance of the eye of the observer from the picture plane is 6 feet, from the plane to the nearest point of the object 1 foot. The height of the eye 4.5 feet. Scale at pleasure.

From *a* in the picture plane, draw the line *ab*, at 40° with *pp*. From *c*, 1 foot within the *pp*, make *cb* equal to the length of the steps, and *cd* equal to the width of the three steps divided in *e* and *f*. The heights to be marked presently on the line of contact. There will be no difficulty in drawing the rest of the plan. Place the station point *sp*, draw the base of the picture, and the *HL* three feet and a half above the base, and find the vanishing point. Bring down visual rays from the ends of the steps at both extremities of the plan. Produce *d* *c* to *h*, and *g* *b* to *k* for points of contact, and bring them down perpendicularly for lines of contact. From the base *i* on *i* *h* mark the heights of the three steps one above the other, and also from *m*, on *m* *k*, numbered on both lines 1, 2, 3, and from each of these divisions draw retiring lines to the *vp*, which, being cut by the visual rays, will give the respective points upon which to draw the ends of the steps, marked again *c*, *e*, *f*, and *d*; their fronts and edges extend between the corresponding visual rays drawn from the *g* *b* end of the plan.

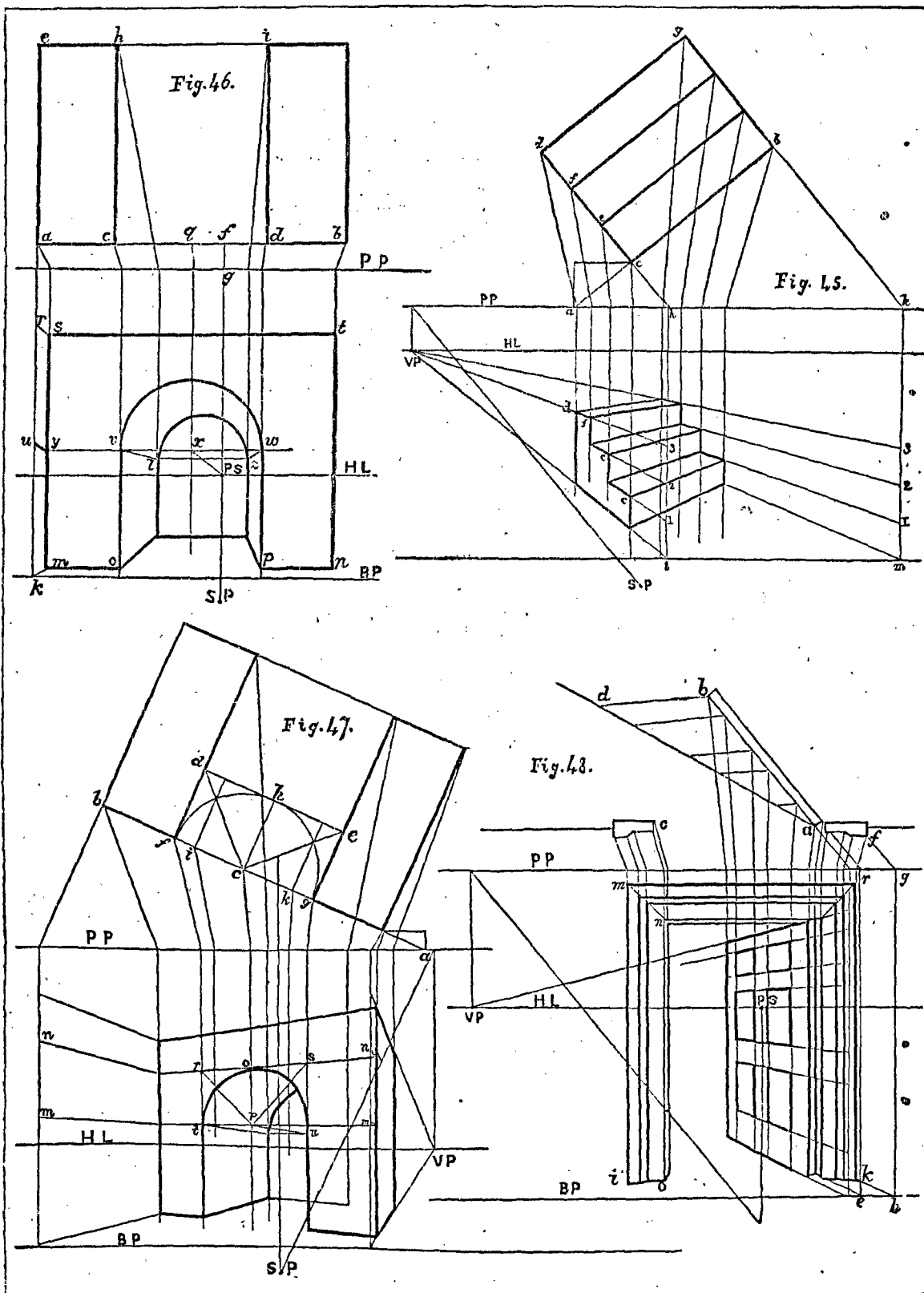
PROBLEM XXV. (Fig. 46).—A rectangular block of masonry 24 feet long, 20 feet high, and 16 feet broad, is pierced by an arch springing at a height of 10 feet, and of semi-circular form, with a span of 12 feet. Let the point of view be on one side of its centre. Distance within the picture plane 2 feet. Height of eye 8 feet. Station point from the picture plane 26 feet. Scale 5 feet to the inch.

We will first draw the perspective view of the arch when the front is parallel with the picture plane. If the pupil has not a scale of inches divided into fifths, he can easily construct one in this manner:—Draw a line, say 6 inches long, to represent 30 feet, and divide it into three equal parts; divide the first division into ten parts, which will represent single feet, and the main divisions will represent tens of feet. Number it similarly to the scales given in Lesson I, Vol. II., page 161.

Draw the *pp*, and two feet beyond, and parallel with it, draw the line *ab* equal to 24 feet; *a* *c* 6 feet, and *c* *d* 12 feet. Draw *a* *e* equal to 16 feet, and complete the rest of the plan as shown in the figure. Place the point *f* a little to the right of the centre, and draw the line *f* *sp*, making *g* *sp* equal to 26 feet. Draw the line *bp* (base of the picture) anywhere below the *pp*, allowing sufficient room for the elevation between the base of the picture and the plan above, also the horizontal line 8 feet from *bp*. Draw visual rays from *a*, *c*, *d*, *b*, *h*, *i*, and bring them down perpendicularly from the *pp*. Draw *ak* perpendicularly to the *pp*, for the line of contact or measuring line for the heights; mark the *ps* (point of sight) and draw *km* from *k* towards *ps*, stopping at the *vr* from *a*. Draw *mn* parallel to *bp*, which will be the perspective front of the base of the building. The visual rays from *c* and *d* will determine the width of the arch *op*. Make the distance *kr* for the height equal to 20 feet. Draw *rs* from *r* as was done from *k*, and draw *st* for the top of the building. At *u*, ten feet from *k*, draw *uy* towards the *ps*, and also *y* *v* *w*; bisect *y* *v* *w*; from *z* as a centre being brought down from *g*, draw the semicircle *uv*; the front of the building will then be completed. For the other end of the arch which spans *hi* of the plan, draw lines *vl*, *wz*, from *v* and *w* to *ps*, meeting the visual rays from *h* and *i* in *l* and *z*; join *l* and *z*, and either bisect it, or draw a line from *z* to *ps*, which, cutting *lz*, will give the centre point from which the interior or further end of the arch must be drawn with a radius from the centre to *l* or *z*. For the base of the interior of the archway draw lines from *o* and *p*, towards *ps*, cutting the visual rays from *h* and *i*; join these points by a line parallel to *bp*; this will complete the perspective elevation.

Fig. 47.—We will now draw the same subject at an angle with our position. Let the angle of the front of the building be 24° with the *pp*. The other conditions as before.

Draw *a* *b* at an angle of 24° with *pp*, and complete the plan upon *a* *b*, as in the last figure. We will use one *vp*, as in Fig.



40, 41, 45, and some others. We trust, after all that has been said upon the method of drawing an object with the use of one *vp*, the pupil will have no difficulty in first drawing the perspective of the block. The principal difficulty will be with the arch, to draw which we shall have to repeat the same principles which were employed for the circle on the board (Problem XX., Fig. 40, page 140); therefore, in order to get the necessary points through which the arch is to be drawn *by hand*, we must rabat the semicircle. From *c* as a centre draw the arc *fhg*; draw *dhe* parallel to *fg*, and the semi-diagonals *cd* and *ce* through the points where these last lines intersect the arc: draw lines parallel to *fd* to meet the front of the plan of the building in *i* and *k*; visual rays must be drawn from *g, h, c, i, f*. From the spring of the arch marked on the line of contact at *m*, make *mn* equal to *fd*; the visual ray from *c* the centre will produce the points *o* and *p*; draw the semi-diagonals *pr* and *ps*; where these last lines intersect the visual rays from *i* and *k*, will give the points through which the arch *t o u* must be drawn *by hand*. We have not entered into the other part of the work, as we have no doubt that our pupils will be able to do it from the experience they have gained in the solution of previous problems.

PROBLEM XXVI. (Fig. 48).—Give a perspective view of a door-frame, a six-panelled door, partly open, the door-frame being parallel to the plane of the picture, and the line of sight two-thirds of the height of the door. (From the Military Examination Papers.)

There are very few conditions given. The door is said to be partly open, therefore it may be placed at any angle at pleasure; the wall and door-frame may be placed at any distance from the *pp*, but they must be parallel to the *pp*; the proportions of the door and frame are discretionary. This is one of those problems which are frequently given at public examinations with very few working conditions. It gives us an opportunity for advising all who may at any time have to compete in these examinations to use some definite scale in the construction; it will probably save a great deal of confusion and much uncertainty. There will be much in the drawing of this subject that has occurred before, all of which we shall pass over to avoid unnecessary repetition of former instructions. In the plan it must be observed that the width of the door *a b* must be made equal to *a c* the space within the frame. The division of *a b* for the plans of the stiles and panels must be proportionally divided, and those proportions must be set off on *a d*. (See Lessons in Geometry, Problem XVI., Vol. I., page 209.) There are three lines of contact; the first is from *a b* produced to the *pp*. Upon this line of contact all the perpendicular measurements of the stiles and panels are arranged. The second line of contact is from the back of the door produced to the *pp*. This is for the purpose of arriving at the perspective thickness of the door; therefore from the bases of these two lines of contact at *e* retiring lines are drawn to the *vp*; these retiring lines cutting visual rays drawn from the end of the door *a* in the plan, will give the perspective thickness of the door. The principal retiring lines are those of the top and bottom of the door, and the horizontal edges of the panels, all drawn from the perpendicular measurements above stated. The third line of contact is *gh*; *fg* being made parallel to *a b* for the sake of the advantage of the same *vp*; a line drawn from the base of *gh* towards the *vp*, cutting *vp* from *f*, gives the position of the base of the frame *ik*. The width of the frame across the top is obtained thus:—*no* being the height of the opening of the door, a line must be drawn from *n* to *m* at an angle of 135° with *no*; consequently, after *mr* is drawn, *m n* will be found to bisect the right angle *r m i*; therefore, the visual rays from the plan of the frame at *c* cutting the line *m n* will produce the points in *m n* from which to draw the mouldings both horizontally and perpendicularly; *rs* will be the *vp* for the interior edge of the frame, as shown in the line drawn from *o*. The great advantage of using several lines of contact will be seen when working the details. We allude to this for the purpose of observing that it is advisable to draw these lines of contact from produced lines of the plan all parallel with each other, so that one vanishing point may be used for all; otherwise, if they are not parallel, other vanishing points will have to be found, because every retiring line must have its own vanishing point.

LESSONS IN GREEK.—XVIII.

ADVERBS AND THEIR FORMATION.

UNDER the name of adverbs we indicate those indeclinable words which denote the relations of time and place, or the relations of way and manner; as *εκει*, there; *νυν*, now; *καλως*, well.

Adverbs of manner are formed from adjectives, by affixing *ως* to the pure stem of the adjective. As a practical rule, you may take this—

The termination *-ων* of the Genitive Plural of the Adjective is changed into *ως*; for example:—

Adjective.	Genitive Plural.	Adverb.
φίλος, loving,	φίλων,	φίλως, lovingly.
καλός, beautiful,	καλῶν,	καλως, beautifully.
ἀπλός, simple,	ἀπλῶν,	ἀπλως, simply.
πᾶς, all,	παντῶν,	παντως, altogether.
σοφρων, wise,	σοφρωνῶν,	σοφρωνως, wisely.
ταχὺς, swift,	ταχέων,	ταχέως, swiftly.
μεγας, great,	μεγαλῶν,	μεγαλως, greatly.
ἀληθής, true,	ἀληθῶν,	ἀληθως, truly.
συνήθης, accustomed,	συνήθων,	συνήθως, according to custom.

The terminations *-θεν*, *-θι*, and *-δε* form adverbs by being added to nouns, pronouns, and verbs, to signify relations of place; thus *θεν* denotes from a place (*whence*); *θι*, at a place (*where*); and *δε*, to a place (*whither*); for example, *οὐρανῶθεν*, from heaven; *οὐρανῶθι*, in heaven; *οὐρανῶδε*, to heaven. With pronouns *δε* becomes *σε*, thus *ἀλλοσε*, to some other place; so with *εκει*, there, as *εκεισε*, thither. In the plural of the substantives in *-ας*, *-σδε* passes into *-ςε*, as *Αθηναίς* for *Αθηναίςδε*; from *Αθηναί*, *-ων*, the city Athens.

Adverbs of place terminate in *-ω*, as *ανω*, above; *κατω*, below; *εξω*, without; *εσω*, within. There are many adverbs which are obviously cases of nouns or pronouns, as *εξαπνής* (so in Latin, *derepente*), suddenly; *που*, somewhere; *δπου*, *οἶ*, where; *αυτου*, on the spot, exactly here or exactly there; *ουδαμου*, nowhere: these adverbs are all genitives.

Accusatives are also common, as *πρωην*, at the dawn; *μακραν*, a long way; *περαν*, beyond a place, whence the country along the east side of the Jordan had the name of *Peræa*, that is, the land beyond; *δωρεαν*, gratis, gratuitously; *σημερον*, to-day (Lat. *hodie*); *αυριον*, to-morrow (Lat. *cras*).

COMPARISON OF ADVERBS.

Adverbs of manner have commonly no peculiar adverbial termination, but employ in the comparative the neuter singular, and in the superlative the neuter plural, of the corresponding adjectives. The same fact may be stated thus, namely, that the neuter singular of comparatives may be used adverbially, that is, with an adverbial signification; and that the neuter plural of superlatives may be used with an adverbial signification, for example:—

	From	Comparative.	Superlative.
σοφως	(σοφός), wisely,	σοφωτερον,	σοφωτατα.
σαφως	(σαφής), clearly,	σαφεστερον,	σαφεστατα.
χαριεντως	(χαριεις), charmingly,	χαριεστερον,	χαριεστατα.
ευδαιμονως	(ευδαιμων), happily,	ευδαιμονεστερον,	ευδαιμονεστατα.
αισχρως	(αισχος), shamefully,	αισχιον,	αισχιστα.
ηδως	(ηδus), pleasantly,	ηδιον,	ηδιστα.
ταχως	(ταχυς), swiftly,	θαττον,	ταχιστα.

Adverbs of place in *-ω* retain that termination in the comparative and superlative.

	Comparative.	Superlative.
ανω, above,	ανω-τερω,	ανω-τατω.
κατω, below,	κατω-τερω,	κατω-τατω.

The comparative and superlative of most other adverbs of place end in *-ω*, as—

	Comparative.	Superlative.
περα, beyond,	περαιτερω,	(none).
τηλου, at a distance,	τηλοτερω,	τηλοτατω.
εκας, at a distance,	εκαστερω,	εκαστατω.
εγγυς, near,	εγγυτερω,	εγγυτατω.

Some adverbs have a reciprocal relation to each other. The simple forms stand as relatives. By prefixing *π* to the relatives,

you make direct interrogatives. Put δ before the π , and you convert the direct into indirect interrogatives, and indirect relatives. Prefix τ instead of π , and then you obtain demonstratives; as—

Simple Rel.	Direct Interrog.	Indirect I. and R.	Demonstratives.
η , whither,	$\pi\eta$, whither?	$\delta\pi\eta$, $\tau\eta$, there, thither.	
$\eta\kappa\alpha$, when,	$\pi\eta\kappa\alpha$, at what time?	$\delta\pi\eta\kappa\alpha$, $\tau\eta\kappa\alpha$, at that time.	
$\delta\delta\epsilon$, whence,	$\pi\delta\delta\epsilon$, whence?	$\delta\pi\delta\delta\epsilon$, $\tau\delta\delta\epsilon$, thence.	
$\sigma\iota$, whither,	$\pi\sigma\iota$, whither?	$\delta\pi\sigma\iota$.	
$\delta\tau\epsilon$, when,	$\pi\tau\epsilon$, when?	$\delta\pi\tau\epsilon$, $\tau\tau\epsilon$, then.	
$\sigma\upsilon$, where,	$\pi\upsilon$, where?	$\delta\pi\upsilon$.	
$\omega\varsigma$, as,	$\pi\omega\varsigma$, how?	$\delta\pi\omega\varsigma$, $\tau\omega\varsigma$, so.	

Of these forms $\sigma\iota$, $\tau\delta\delta\epsilon$, and $\tau\omega\varsigma$ are found only in the poets, and consequently are not to be ordinarily used in prose composition.

EXERCISES FROM THE CLASSICS.—GREEK-ENGLISH.

1. Παν το σκληρον χαλεπω βατατται. 2. Ο ουρανός χαλκός ἐστι τα ἐξω. 3. Ελεγεν ὁ Βίας, ατυχὴ εἶναι τὸν ατυχὴν μὴ φερόντα. 4. Ἡ φιλοσοφία διδάσκει, ὅτι δεῖ μὴ ἐν ταῖς εὐπραγίαις περιχαρὲς ὑπαρχειν, μὴ ἐν ταῖς ὀργαῖς περιπαθεῖς καὶ θηριώδεις. 5. Πῶς ἡ ἀχαριστοὶ, ἡ ἀμελεῖς, ἡ πλεονεκτοῦσα, ἡ ἀπιστοὶ, ἡ ἀκρατεῖς ἀνθρώποι δύναται φίλοι γίνεσθαι; 6. Ο πλούτος καὶ τὰ ἐκτὸς ἀγαθὰ χωρὶς ἀρετῆς ἀνωφελῆ εἰσι τοῖς ἐχούσι. 7. Τὸ ὄντως εὐφρονέστερον ἐστὶν ἀδανός; 8. Αἱ δυνεῖται παῖδες φροντίζουσιν σοφώτεροι. 9. Δαρείου καὶ Παρυσάτιδος γίνονται παῖδες δύο· πρεσβύτερος μὲν Ἀρταξέρξης, νεώτερος δὲ Κύρος. 10. Γυναῖκες ἀνδρῶν φιλοπενθεῖσθαι ἐπιθυμοῦσι. 11. Τὸ ἀδικεῖν κακίον ἐστὶ τοῦ ἀδικεῖσθαι. 12. Ὁ Ἀγροίκος περὶ τοῦ μεγάλου βασιλέως εἶπεν, ὅτι γὰρ ἐμὸν μείζων ἐκείνος, εἰ μὴ καὶ δικαιοτέρος; 13. Ζήνων δὲ τὸν Θεοφράστον ἐπὶ τῷ πολλοῦ ἐχέει μανθῆτας θαυμάζομεν, ὃ ἐκείνου μὲν χορὸς, ἐφῇ, μείζων, ὃ ἐμὸς δὲ συμφωνότερος. 14. Σοφὸς Σοφοκλῆς, Εὐριπίδης σοφώτερος, ἀνδρῶν δὲ πάντων Σωκράτης σοφώτατος. 15. Ἡ μελιττα φυσικῶς ἐν τοῖς ἀνθεσὶ ἐκανεύσκει τοὺς λειοτάτους μελὶ καὶ χρηστικώτατον. 16. Πάντες, ἂ ἐπιστάνται, βασιτα τε καὶ ταχίστα καὶ καλλίστα καὶ ἥδιστα ἐργάζονται. 17. Καλῶς καὶ ἀνδρείως ἕκαστα ποιεῖ. 18. Ὁ Ἀστυάγης, καλῶς, ἐφῇ, ἐποίησας, προεῖπων. 19. Τοὺς ἀλίσκομενους, ὡς κακῶς κλεπτόντας τιμωροῦνται. 20. Ἀδελφὸν ἐστὶ εἴτε βελτίον εἴτε κακίον ἐστὶ. 21. Πῶς καλλίον ἡ εὐσεβεστερον τιμῇ θεοῦ. 22. Σωκράτης ἰδὼν μεναικίον πλουσίον καὶ ἀπαιδευτόν, ἰδὼν, ἐφῇ, χρυσὸν ἀνδραπόδον.

VOCABULARY.

1. Σκληρός, -α, -ον, dry, hard; παν το. The article is frequently used in Greek when it must be omitted in English, as in general propositions; μαλαττομαι, I am softened.
2. Τα ἐξω, in regard to the things without, that is, on its exterior.
3. Τὸν μὴ φερ., that he who could not bear misfortune.
4. Εὐπραγία, -ας, ἡ, prosperity, literally, well-doing, from εὐ and πράττειν, I do, I am in a certain condition, as in our phrase, "How do you do?" περιχαρής, very joyful, περι gives the idea of much or excess; ὀργη, -ης, ἡ, anger, here used for adversity, considered as a consequence of the anger of the gods; περιπαθής, -ες, suffering greatly, acutely sensible to suffering; θηριώδης, -ες, like the animals, low, downcast.
5. Αχαριστός, -η, -ον, ungrateful; ἀμελής, -ες, neglectful; πλεονεκτής, avaricious; ἀπιστός, unfaithful.
6. Ἐκτός, adv. without; τὰ ἐκτ. αἱ. external goods, advantages; ἀνωφελής, -ες, useless; χωρὶς, apart from; τοῖς ἐχούσι, to those who have (them), that is, their possessors.
7. Πῶς, how, somehow, some way, in a measure; the adverb restricts or qualifies the statement.
8. Δαρείου καὶ Παρυσάτιδος. These genitives depend on παῖδες; we should say, D. and P., have two sons.
9. Φιλοπενθής, -ες, fond of mourning; πένθος, -ους, τὸ, grief, lamentation.
10. Τὸ ἀδ. The infinitive mood with the article is often equivalent to a noun in English: to injure another is worse than to suffer an injury.
11. Ὁ μέγας βασιλεὺς, the great king, that is, the king of Persia, who was the great king to the Greeks; ἐκεῖνος, he, that one.
12. Ὁ ὄντως εὐφρονέστερος, the great king, that is, the king of Persia, who was the great king to the Greeks; ἐκεῖνος, he, that one.
13. Ὁ ὄντως, seeing, pres. part. from ὄρω; ἐπὶ τῷ, etc., in consequence of having many disciples; χορὸς, our chorus, here class, audience; συμφωνός, -ον, agreeing, harmonious; ὃ ἐμὸς, mine; literally, the mine.

14. Ἀνδρ. παντ. σοφωτ. etc. The superlative governs a genitive; thus we say in English, "the fairest of women."

15. Φυσικῶς, naturally, by natural impulse; λείος, -α, -ον, soft, mild, sweet; χρηστικός, -η, -ον, useful.

18. Εποίησας (from ποιεῖν), thou hast done; προεῖπων, in foretelling (that).

19. Τοὺς ἀλίσκ. the captives; ἀλίσκειν, to take, capture; κλεπτεῖν, to rob; τιμωροῦμαι, I punish.

20. Ἐσται, it will be, future of εἶναι.

21. Τιμῇ, could he honour? τιμᾶω, I honour.

22. Μεναικίον, a young man; ἀνδραπόδον, -ον, τὸ, a slave.

EXERCISE 61.—ENGLISH-GREEK.

1. Wise men seek not external advantages. 2. Women suffer very much in adversity. 3. An intemperate man cannot become a faithful friend. 4. The nightingale is the sweetest (in voice) of birds. 5. Girls are more given to sorrow than women. 6. The wisest (man) is greatest. 7. I am admired for having much wealth. 8. How can men admire me for having much wealth? 9. My brother is wise, my father is wiser, the philosopher is wisest. 10. Children naturally love their parents. 11. Fight, O citizens, well and bravely for (περὶ) your (the) city.

KEY TO EXERCISES IN LESSONS IN GREEK.—XVII. *

EXERCISE 57.—GREEK-ENGLISH.

1. The deepest sleep is the sweetest. 2. Many flowers yield a very sweet smell. 3. Nothing is swifter than youth. 4. The incontinent serve a most vile servitude. 5. Friendship is the sweetest of all things. 6. Nothing is more disgraceful than to have one thing in the mind but to say another thing. 7. Serpents are most odious to all other animals. 8. Nothing is more hateful to man than man. 9. Swiftly does time bear things away with it.

EXERCISE 58.—ENGLISH-GREEK.

1. Οὐδὲν ἥδιον ἐστὶν ἢ βαθεῖα ὕπνος. 2. Ἠδίστος ἐστὶν ὕπνος. 3. Οὐδὲν αἰσχίον ἐστὶν τῆς δουλείας. 4. Οὐβότατον ἐστὶ δουλεία. 5. Ἰπποὶ εἰσι ταχίστοι. 6. Οὐδὲν ἐχθίον ἐστὶν ἢ βούλη κακῇ. 7. Λίσχιον ἐστὶν ἀλλὰ μὲν λέγειν, ἀλλὰ δὲ ἐν τῷ ᾧ ἐχέειν. 8. Οἱ πανήτορες ἀλλὰ μὲν ἐν τῷ ᾧ ἐχέειν, ἀλλὰ δὲ λέγειν. 9. Οὐδὲν ἐστὶν ἥδιον πιστοῦ φίλου.

EXERCISE 59.—GREEK-ENGLISH.

1. The longest life is not the best, but the most virtuous. 2. Moderation is the best in all things. 3. The judgments of the more aged are the better. 4. No counsellor is better than time. 5. Either utter things better than silence or keep silence. 6. That which is most secure is always the best. 7. You jeer, O excellent friend. 8. At times cowards are more fortunate than brave men. 9. There is no worse evil to man than grief. 10. Flattery is the worst of all the other evils. 11. A man soft in soul, and even capable of bribery. 12. Prudence is the fairest virtue for women. 13. There is no nobler possession than a friend. 14. Slavery is most painful to a free man. 15. The way is very long. 16. The crocodile grows very big from being very little. 17. The earth is less than the sun. 18. Be content even with less. 19. Very few men are happy. 20. No law is stronger than necessity. 21. Small gains often produce greater damage. 22. No evil is greater than anarchy. 23. War brings very many evils. 24. A desire for more is natural to man. 25. A good woman brings to her house very many good things. 26. Bear the necessities of life as easily as possible. 27. To order is easier than to do. 28. The fruits of wisdom are very ripe. 29. The branches of the vine in my father's garden are riper than in my neighbour's garden. 30. Iberia rears very fat sheep.

EXERCISE 60.—ENGLISH-GREEK.

1. Οὐδὲν βελτίον πρακτικόν βίον. 2. Ἡ δόξα τῶν πολλῶν ἐστὶ κρατίστη. 3. Ὁ χρόνος ἐστὶ συμβούλος ἀμείστος. 4. Τὸ ἀσφιλίστατον ἐστὶ κρατίστον. 5. Ἡ λεπτή ἐστὶ κακὸν μέγιστον. 6. Οὐδὲν ἐστὶ χειρόν ἢ κολεῖα. 7. Ὁ ἀκράτης τὰς ἡδονὰς δουλεύει. 8. Γυναῖκες ἐστὶν οὐδὲν κακίον τῆς σοφίας. 9. Τὴν εὐδαιμονίαν οὐδὲν ἐστὶν κακίον τῆς δουλείας. 10. Ὁ κροκοδείλιος μέγιστος ἐστὶ. 11. Ὁ ὕψος μείζων τοῦ πατρός. 12. Τοῖς κακοῖς ἐστὶ πολλὰ καὶ πλείονα ἢ τοῖς ἀγαθοῖς. 13. Πόλεμος φέρει πολλὰ κακά. 14. Τὸ μὲν κελεῖν ἐστὶ ῥαδίον, τὸ δὲ πείθεσθαι ἰσχυρόν. 15. Οἱ κακοὶ περὶ αἰσθητὰ εἰσὶν ἥδίστοι. 16. Τα προβατὰ τοῦ πατρὸς ἐμὸν εἰσι πιστότερα ἢ τὰ τοῦ πλησίον.

HISTORIC SKETCHES.—XXXI.

ANCIENT EGYPT.

THE interest attaching to Egypt and the Egyptians cannot fail to be great, not only for the strictly historical student, but for every one who has read the Old Testament Scriptures. To the historical student the history of Egypt must be especially interesting, seeing that the civilisation of Egypt was the proto-

type of all the great historical civilisations in the world; and that Egyptian influence, Egyptian conquest, Egyptian colonies, made their impressions upon the whole of the known earth. To the reader of the Bible narrative must have come many a prompting to learn more than is there given about that singular people whose history, when it touches that of the Jews, is recorded with such vivid exactness, but is barely, if at all, told when it has no reference to the chosen people. "Now there arose up a new king over Egypt, which knew not Joseph," is the only information given in the Bible concerning a whole period of history during which the country was conquered from without, and an entirely new race of people took the mastery. There was no need, if we may presume to say so, to give more information for the purposes of the Mosaic history, the object there being to contrast the treatment of Israel at one period with the treatment at another, in order to show the necessity there was for bringing them out of the land of Egypt, even with a mighty hand and a stretched-out arm. But the student may reasonably inquire what were the circumstances under which the whole policy of the Egyptians towards the Israelites became so changed; that whereas at one time a large province was allotted to the strangers, and every encouragement was given for them to live happily in the land, at another time the hand of every man was against them, and they were made to endure slavery in the country where their fathers had been princes.

Materials for an account of ancient Egypt are extremely few, for an historic sketch almost as scanty. The Bible furnishes by far the greatest number of serviceable links in the chain, but these are not enough to enable us to dispense with further information. Such further information has been obtained by means of traditions, by the records of other nations upon which the Egyptians set their mark, and by the histories engraven in hieroglyphics upon the walls and statues of the Egyptian palaces and tombs. These hieroglyphics have, by dint of long and industrious perseverance, been so far deciphered, that if no grammar has been educible from them, it has yet been possible to frame a system of interpretation applicable to hieroglyphics generally, and so to read those sermons in stones which the ancient Egyptians carved for the instruction of those that should come after. By this assistance it has been possible to decide upon the *locus in quo* of many an historical event: battles, changes of dynasty, manners and customs, mode of government; and the advent of rational blessings and calamities are thus chronicled. Prominent facts stand out in relief against the blank wall of time, and serve as marks by which to trace the march of the people from their origin to their historical grave.

Originally it appears that Egypt was divided into a number of small states, whereof Memphis was the most powerful. The Pharaohs, of whom Abraham heard and whom he visited, reigned there and were powerful princes, obeyed by a numerous aristocracy, and by a large and thriving population, skilled in all the arts by which nations grow rich. Whether they ever reigned over the whole country is questionable, but it is certain they commanded it either in sovereignty or by alliances, and that their word was law throughout Egypt. The people were excellent agriculturists, and seem early to have taken advantage of the river's overflow to get extra corn crops out of the ground annually inundated; they were also good mechanicians, elegant architects, and truly wonderful builders. In the sciences of mathematics and astronomy they were more learned than any of their contemporaries, except perhaps the Chinese; and their pursuits generally were those of a people more wedded to the arts of peace and civilisation than to those of war. Indeed, they appear to have been almost too indifferent to the science and practice of war, for on their borders to the south were the aggressive Ethiopians, ever ready to take advantage of the weakness or unreadiness of an enemy; and on the west were those children of the desert, the wandering shepherd tribes, who availed themselves of every opportunity to assail their wealthy and tempting neighbours. It must not be supposed, however, that the Egyptians were altogether neglectful of the art of ensuring peace by preparing for war. They had a very complete and very efficient military system, and their arms, both offensive and defensive, were superior to those of all the surrounding nations; their war-horses—used for chariots rather than for cavalry purposes—were of the finest breed, and great care was taken to maintain the breed unsullied. In the use of chariots drawn by two horses, and manned by a charioteer,

who drove and also protected his companion with a shield, and by a warrior, the Egyptians were specially famous. Their skill in archery was proverbial, and the exactness of their drill, and the compactness of their battalions, were subjects of universal admiration. The idea of military glory was embodied in the rule of caste which placed a warrior second only to the priest in the social and political scale; and in the earlier and middle periods of Egyptian history, this idea found practical expression in expeditions against native rival states, and against foreign foes. Excellence in peaceful arts and sciences was, up to a certain time, found to be compatible with proficiency in war; and it was not till the Egyptians, yielding to the enervating influences of luxury and of climate, reposed for their security upon the dread of their renown, rather than upon present strength, that their enemies ventured to find out in what parts they were vulnerable. The decline of the military power of the original Egyptians, if such a term may be applied to people who are supposed to have had their origin in a branch of the Hindoo family, began to be marked some little time before the advent of Joseph into the country. The Hyksos, or wandering shepherd tribes, had made several successful raids from their deserts into the land of plenty; and though driven out with the strong hand, it was only by efforts which taxed the strength of the government, while the marauders carried back with them into their deserts the memory of a country rich in all the wealth of nature and art, and peopled by a race in whom prosperity was beginning to develop its weakening influence. The people also who in times of distress came to Egypt to supply their wants saw at once the wealth and the "nakedness of the land," and noted what they saw as a fact to be treasured up against the time when they could use it to their own advantage.

It was perfectly natural, therefore, that the Egyptians, conscious of the bait they were to men who had nothing to lose and everything to gain by a war, should, with the further consciousness of their own growing inability to defend themselves, have been particularly jealous of the prying eyes of strangers. It was this jealousy which gave Joseph a pretext for feigning anger against his brethren. "Ye are spies!" "To spy out the nakedness of the land are ye come down," was the very language an Egyptian ruler might reasonably have used to strangers who had come from the dreaded country of the wanderers, and who might, impelled by hunger for "the corn in Egypt," or moved by the inhospitable character of their own home, return in numbers, and accomplish the subjection which the Egyptians were beginning to fear. The same jealousy, had no rule of caste supplemented it, would have made the Hebrews, equally with other shepherds, "an abomination unto the Egyptians," even to preventing the Egyptians from eating at the same table with them.

This dread of evil to come out of the desert was not misplaced. The natural tendency of a nomad population, which has increased so that the wandering space at its disposal is insufficient for its wants, is to pour over the frontiers of the nearest civilisation, to wage war upon it, and finally to overcome it, or to be absorbed within it. The wise king who ruled Egypt in Joseph's time seems to have apprehended this rule, and knowing that ere long he might expect to see its application to the desert men and Egypt, took the statesmanlike precaution of offering upon the frontier a home to the best of the wanderers—men who, besides being warlike, and able therefore to bear the brunt of first attacks, were intellectually and morally far in advance of all their compeers, and might, as Joseph had done, "inform his princes" and "teach his senators wisdom." Hence the settlement in the land of Goshen. The Israelites emigrated *en masse* to the land that flowed with milk and honey, and the Egyptians enjoyed the benefit of their presence, both as warders against invasion from the west, and as the possessors of a civilisation hardly inferior to their own. The wisdom of the government made every provision for the encouragement of the Israelites in their new home, even causing a jealousy to spring up in the breasts of the Egyptians against them; the new-comers taught the people many new and desirable things, and the first blows of invasion fell upon them instead of upon the native population. For many years all went well with the two peoples, who lived together in unity, though, of course, in that distinctiveness which was characteristic of both of them, but especially of the Hebrews, who then, as now, were "a peculiar people," separated by indelible natural marks from all the rest.

of mankind. Then there "arose a Pharaoh who knew not Joseph." The Hyksos, or shepherd kings of the vast districts on the west of Egypt, gathering their forces, took an opportunity, and came upon their enemies like a thunder-clap. Vain was the interposition of the Israelites between the desired land and its assailants; vain was the military system, perfect as it was supposed to be, of the great Egyptian monarchy. The half-savages of the deserts were an overmatch for the refined soldiers of the kingdom, and the old civilisation went down before the mighty onset of the invaders like chaff before the wind. The ancient dynasty of the wise Pharaohs, who had ruled equitably and striven to do right, was ended; a shepherd chief, indeed an abomination to the Egyptians, was seated on the Egyptian throne, and a rule was established at once subversive of the Israelitish and old Egyptian brotherhood. The Pharaoh who "knew not Joseph"—that is to say, who was not bound by the ties which knit Joseph's descendants (for Joseph had been dead long years before) to the Egyptians—governed tyrannically over both peoples alike, bruising both of them in pieces, like a potter's vessel. The Egyptians proper, being the more numerous, and the more necessary to the conquerors, fared better than the Israelites, who were doubtless looked upon as deserters from the cause of the wandering tribes, and were punished as traitors who had made common cause with the enemy. They were particularly oppressed, they were set on labour not only derogatory in itself, but hard beyond compare, and even insulted in every possible way both as regarded their nation and religion. From having been the friends of princes they became the slaves of servants, and were forced "to endure in a strange land all the miseries and indignities of the most servile peoples. Under the late rule their religion, though regarded with jealousy and dislike by the priesthood, had been liberally tolerated, and "in the land of Goshen, where the children of Israel dwelt," had been allowed to be the prevailing faith. But now things were altogether different. With difficulty could the descendants of Abraham preserve their distinctiveness; it was almost impossible for them to worship God according to the rites which tradition bade them observe; their labour was incessant, the severity of their taskmasters was unrelenting, and no amount of zeal, no amount of submissiveness, served to bring an amelioration of their condition. The new masters were insensible to pity; careless whether or not they destroyed the Israelites as a population; anxious only, while their own rule lasted, to get as much work as possible out of the wretched folk. Many of the people died under the unwonted burdens laid upon them, others took to heart the deep teaching of adversity, and acknowledging the hand of God in the afflictions which were sent upon them, chastened their minds and purified their hearts, and became gradually fitted for the great change which was thereafter to come to them under the guidance and apostleship of Moses. What that change was, how it was wrought, and the effect it has had upon the whole world since that time, will be traced in the historic sketch of the Jewish nation which it is proposed to make one of the present series of papers. Enough here to know that soon after the departure of the Israelites by the mighty hand and stretched-out arm of the God of Israel, the power of the shepherd kings waned and drooped, and was ultimately overthrown by a well-planned insurrection of the Egyptians.

The people rising again from their ashes, in which had lived their "wonted fires," grew more powerful than before the conquest by the Hyksos. The King of Thebes extended his empire over all Lower Egypt, annexed the greater part of Nubia, and having driven the Hyksos into fortresses, finally compelled them to surrender, and did to the defenders according to the universal, cruel custom of the Egyptians. Although it happened that the Hyksos again made head, and bringing in reinforcements from the desert, drove the reigning king from his throne, they never more made serious havoc with the Egyptians, and were themselves finally driven out by the aid of an Ethiopian army. Then came an era of great glory for the Egyptians. Sesostris (Rameses the Great) united all the Egyptian states under one king, and developing the resources of the land, grew mighty and flourished. His conquests extended from the extreme south of Ethiopia into Persia and Greece. Large portions of eastern Arabia acknowledged him, and it is said that he even made preparations for the conquest of India, by means of his fleets, which were built on the Red

Sea, and passed out through the Straits of Bab-el-mandeb. Men of all colours and of all nations were among his prisoners, and he had the wisdom to profit by what his enemies could teach him, and to establish at home the arts and manufactures which his captives knew. Although uncertain, it appears probable, that the conquests of Sesostris, extending to Syria and Palestine, took place during the wanderings of the Israelites in the desert; and if so, by weakening native princes whose territories were not retained, must materially have assisted their occupation of the promised land.

After Sesostris came many weak princes, relieved now and again by the presence of some strong men; but for three hundred years after the death of the great conqueror little is known of Egyptian history, the Scripture record making scarcely any mention of it. About a thousand years before Christ, Shishak, King of Egypt, made war upon Palestine, and was one of the first scourges sent by the Almighty upon Israel to bring them back to a knowledge of Him whom they so systematically deserted; but the power of Egypt was broken by many distant expeditions, and after Shishak's reign declined rapidly. The throne was accessible to whoever was strong and bold enough to seize it—even strangers occupied it; and the manifest weakness of the once mighty empire attracted the greedy attention of those who were on the look-out for conquests. In the year 713 B.C., Sennacherib, King of Assyria, then one of the mightiest princes on the earth, invaded Egypt with an army which, but for a pestilence which struck down thousands of the troops, must easily have conquered the whole land; but the sickness was such that the Assyrian army had to turn back, and going up to Jerusalem died there. After this the Egyptians as a nation may be said to have become extinct, so large was the admixture of foreign blood and foreign institutions. Soldiers were brought in from without, and men of no known country became kings. Some of the kings—Pharaoh-Necho, for example, B.C. 616—infused the energy and strong will of a new man into the administration, and for a while caused Egypt to shine forth with even more than pristine splendour. His fleets scoured the Mediterranean and Red Seas, and pushed into Indian waters; and it is asserted that an expedition, fitted out at his cost, sailed down the east coast of Africa, discovered and rounded the Cape of Good Hope, and returned home after an absence of three years, by way of the Atlantic and the Straits of Gibraltar.

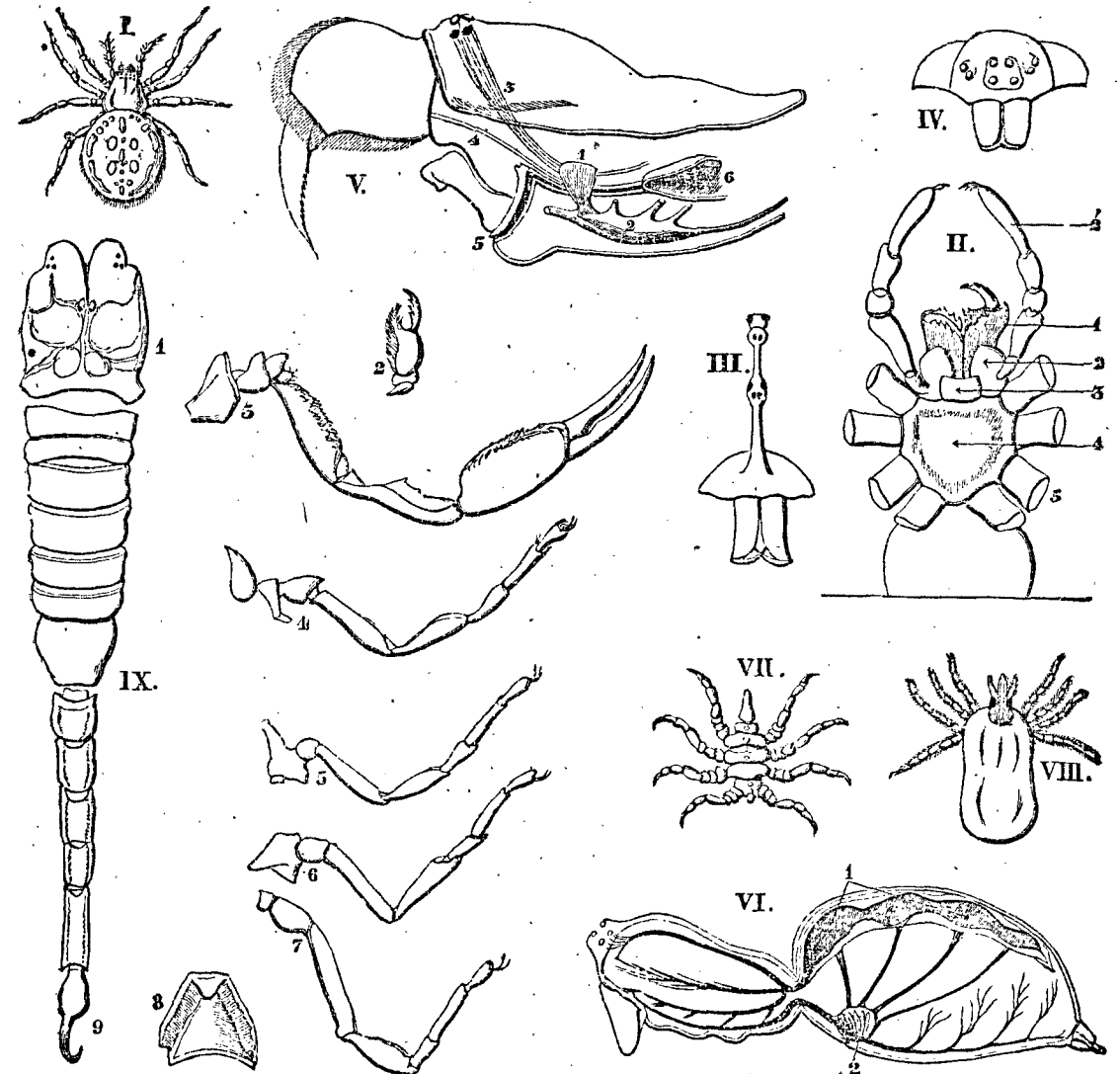
But Egypt had had its day as an empire, and was doomed to fall under the advance of newer civilisations. Cyrus the Persian struck the first great blow at her, and Cambyses, his son and successor, effected her subjugation, put all her chief nobles to an ignominious death, and compelled her wretched king to drink poison. The Persians, who had a religious hatred as well as the contempt of conquerors for the Egyptians, oppressed the people almost worse than the Egyptians had done by the Hebrews many centuries before. The temples were defiled, the sacred animals were slain and eaten, and the priests of Egypt—hateful to the Persians, who detested all priests whatever—were made to bear almost unendurable oppression. The history of Egypt, therefore, during the whole period of the Persian occupation, is a record of constant desperate rebellions, fiercely and pitilessly repressed; and this state of things continued until the overthrow of the Persian power in Asia by Alexander the Great. He, in the year 332 B.C., entered the country, wrested it from the Persians, and built the city of Alexandria and established the great library there. Upon his death the empire he had founded fell quickly to pieces, and the several members of his dominions came into the hands of whoever could seize them. Egypt once more passed under native rule, and became again famous in history under the Ptolemies, whose line, ending in Cleopatra, lasted two hundred years, and then succumbed to the overshadowing power of the Romans. In the year 30 B.C., and under the auspices of Augustus Cæsar, Egypt became a Roman province. What part she played in after history—how she was the seat of one of the chief Christian churches—how monachism began there—how Christians devoid of the spirit of Christ behaved unchristianly, and becoming unworthy were swept away by the tide of Saracenic conquest—how Saracens yielded in the end to Turks—all these things are matters of history, and may possibly be related in other papers; but the limits proposed for the present subject do not allow of extension of treatment, and the sketch remains, therefore, essentially one of the history of purely ancient Egypt.

COMPARATIVE ANATOMY.—XIII.

ARACHNIDA.

The type of this class, and that which gives it its name, is the common spider. According to Greek mythology, Arachne was the daughter of a famous Lydian purple-dyer. She so excelled in weaving that she challenged the great Athena, goddess of all

less needlessly destructive of these creatures, which are neither ugly nor uninteresting, it is worth repeating. The unfortunate Arachne still weaves her inimitable fabrics, and still hangs suspended from our ceilings, while the omnipotent housemaid, goddess of this lower sphere, still rends her web, and drives the weaver to despair. The little metamorphosed Lydian dyer's daughter excites a childish disgust, which is handed down from



I. EPEIRA QUADRATA, A COMMON BRITISH SPIDER. II. UNDER-SIDE OF CEPHALO-THORAX OF AGELINA. III. FRONT OF CEPHALO-THORAX OF MYGALA ACUMINATA, WITH ITS EYES MOUNTED ON A WATCH TOWER. IV. DORSAL VIEW OF EPEIRA. V. CEPHALO-THORAX OF MYGALA, SHOWING THE RELATION OF THE NERVOUS AND ALIMENTARY SYSTEMS. VI. DIAGRAM OF SECTION OF SPIDER, SHOWING ITS BLOOD-VASCULAR SYSTEM. VII. PYCNOGONUM LITORALE. VIII. IXODES (DOG-TICK). IX. SCORPION. Ref. to Nos. in Figs.—II. 1, mandible, or antennary jaw; 2, maxilla; 2', its palp; 3, labrum; 4, breastplate; 5, origin of legs. V. 1, brain; 2, thoracic ganglion with the cut ends of the nerves of the legs; 3, optic nerves; 4, mandibular nerves; 5, mouth; 6, commencement of stomach. VI. 1, Four-chambered heart; 2, lung. IX. 1, cephalo-thoracic shield succeeded by the abdominal segment; 2, mandible; 3, maxilla, with its pincer-like palp; 4, 5, 6, 7, legs; 8, comb-like organs on the sternum of the tenth segment; 9, telson, or sting.

the arts, to compete with her. To display her skill she wove a piece of tapestry representing the loves of the gods, which was so faultless that Athena herself could not find a flaw in the design or execution. Not to be baffled, the goddess did what so many mortals do when surpassed by others—she tore the masterpiece to fragments. Arachne, in despair, essayed to hang herself; but Athena, more in anger than in kindness, changed the rope into a cobweb, and Arachne into a spider. If this legend should induce any one to be a little more considerate, or a little

generation to generation; but if any one will substitute a reasonable examination for an unreasonable avoidance, he will find that beautiful which he preconceived was ugly, and that interesting which he misjudged as repulsive. In those dark ages when superior wisdom and virtue were more certain to bring to their possessors hopeless imprisonment than the greatest crimes, many a solitary prisoner of refined and appreciative nature has waited to see the little Arachne descend from the roof of his cell with as much impatience as any lover beneath the casement

of his love. Since the spinning faculty is that which is most intimately connected with our idea of a spider, it was extremely natural that the old Greeks should make the spider represent a woman. Despite its false fame of ugliness, we, who call single ladies spinsters, naturally associate the spider, or spider, with them. Unfortunately for the reputation both of spiders and women, we cannot stop short in admiration of the art displayed in the construction of the web, but the mind runs on to the design and uses for which the art is employed. These designs are to ensnare and to destroy. Hence deceit and cruelty, the vices of the weak, have been attributed to spiders. The bitterest satirists of the fair sex have found in the spider a simile which has pointed their invective from the earliest ages of literature. Thus, in one of the most famous tragedies of Æschylus, when the chorus find Agamemnon slain in his bath by his deceitful wife Clytemnestra, they exclaim—

“Κεῖται δ' ἀράχνης ἐν ὀφθαλμοῖς τοῦ
ἀσβεβέος θανάτου βίον ἐκπνεύων.”

(“Thou in the female spider's toils art lying,
And breathest forth thy life, dishonoured dying.”)

Since the spider is the type of the class, we shall first call attention to the character which it possesses in common with the whole class Arachnida; then proceed to describe the structure of the common spider in detail; and finally notice the variations of this type in the different divisions of this class, such as scorpions, mites, etc.

The Arachnida are articulated animals, whose bodies consist of a longitudinal series of segments like those of insects. This segmentation into rings is, however, often less marked than in insects, and in the true spiders, which have a smooth soft integument, the divisions are rather inferred, from tracing them in allied forms or in the embryonic state, as they become more and more obliterated, than from any indication of their actual presence in the adult animal. In all cases they are distinguished from insects by having no marked division between the head and thorax. Both these divisions are combined, as in the higher crustaceans, into one piece, called the cephalo-thorax. In the mites a still further amalgamation of the divisions of the body into one globate bag occurs, which represents at once head, thorax, and abdomen. Where there is a constriction between the thorax and abdomen, so that one can be distinguished from the other, the limbs are wholly confined to the thorax. This distinctive feature cuts them off from the Myriapoda and Crustacea. The Arachnida never possess wings, and instead of the three pairs of legs of insects, they have four pairs. These limbs are all jointed, but they are built upon a somewhat different type to those of insects, as we shall find when we come to describe them more minutely.

They have no antennæ for the purposes of touch. These, however, are probably represented by the great poison-jaws. These jaws are so utterly different in form and function from the feelers of insects that it is only by a careful examination, combined with a good deal of speculative reasoning, that they have been identified with them. Thus the absence of antennæ (in the proper sense) is a good distinctive character. Other jaws, situated further back, are possessed by the Arachnida, the most distinctive feature of these being the usually enormous development of the palps which correspond to the flagra or flabella of the crustacean limbs. These palps are so elongated and jointed in the spiders that they would be taken for legs by an ordinary observer, and hence spiders appear to have ten instead of eight legs. In scorpions these maxillary palps are larger than any of the other limbs, and will be described hereafter. The eyes of the Arachnida are, when they are present, always simple and few in number—eight, six, four, and two being the common numbers found. They never have a multitude of hexagonal or quadrate ocelli grouped into one organ as insects have. The method of breathing is very various in the class, the lowest having their juices oxygenated through the skin, others having tracheæ like insects, while the highest have what are called lungs, or, more properly, pulmonibranchiæ, to be described hereafter. The sexes are usually distinct, the females exceeding the males in size. With the exception of the Pantopoda (or Pycnogonida), a doubtful order, allied to the Crustacea, none of the Arachnida are marine in their habitat. Some of the lower orders inhabit fresh water, as, for instance, the littlescarlet water-spider. The major part live in and breathe air.

We will now take a common spider as the example of the class, so that we may go into detail without misleading the reader by the idea that the description will apply to other members of the class.

The cephalo-thorax is a somewhat flattened segment. Its integument is of a harder consistence than that of the abdomen. The upper plate is called the shield, and the lower the breastplate or sternum. Between the edges of these two, along the sides of the body, spring the legs. The shield is wider than the breastplate, and overlaps it, so that while the bases of the legs are well seen from below they are not seen from above. The shield is usually narrower in front, and wider and heart-shaped, or rounded, behind. It is raised into a conical protuberance at the fore part, and on this the eyes are set. Two lines of depression run on each side of the cone, and from these other lines run off to the spaces between the legs, while a marked dent is often seen at the middle of the hind part. The breastplate is often rounded, or heart-shaped, with the apex backward, or in the form of an escutcheon. The box of the cephalo-thorax contains the stomach, main nervous masses, and the muscles of the limbs. The eyes in the common spider are eight in number, in two transverse lines of four each. They are, however, in the various species very differently situated, and of different relative size. Their relative position, number (two, six, or eight), and size are much depended on to distinguish the genera. Sometimes they are mounted on a pyramid, or elevated watch-tower, which rises from the shield in a very grotesque manner. The mandibles spring from under the truncated front of the shield, and are directed downwards. They are of two joints, the thick descending basal joint having attached to the outer part of its end a hooked claw, which works on a joint, so that the point of it can play from the side towards its fellow on the other side. When the claw is completely flexed, it lies in a groove which runs along the far edge of the rear joint. This groove has its two walls generally armed with points or teeth. The maxillæ, or under-jaws, consist of two plates, the inner edges of which are in motion approximated or removed from one another. Their edges and upper surfaces are often studded with small spines. From the base and outside of these plates arise the long-jointed palps, which in the female end in claws like the legs. In the male a very complex organ is found, which can be doubled up into a rounded fist, by which the adult male can be readily distinguished from the female. The lower lip, or labrum, is of various shapes, but usually quadrate. The legs are seven-jointed. The first joint is called the coxa, or haunch; the second, the trochanter; the third, the femur. These last two form the thigh, and to this point the legs are like those of insects. The tibia, or shank, which is whole in the insect, is in spiders of two pieces; while the foot, instead of being in five small bead-like joints, is of two pieces only, and they are of the same thickness as the joints which precede them. The last joint has two, three, or more movable curved claws which are often toothed like a comb. On the under-side of both joints there are sometimes found pads, hairs, or spines, which can be opposed to the claws, and so form an effective hand for weaving.

The abdomen is a globular or oval bag. It often overhangs the thorax in front. Its walls are very flexible and elastic, as is necessary, in that at certain seasons it is distended with eggs. It contains the major part of the fat and liver masses, the organs of generation, and the web-secreting glands. It is attached to the front segment by a very narrow stalk. Through this thin stalk, however, prolongations of almost all the organs of the body are carried. Thus the alimentary canal and the small hinder continuation of the nervous cord pass from the cephalo-thorax to the abdomen, and the blood-system is continued forward from the latter to the former. If the spider be placed on its back, two plates, with a slit on the inner side of each of them, will be seen. These plates cover the breathing cavities, or pulmonibranchiæ, as they and their contents are called. Between them is the opening of the generative organs. The anus is at the extreme end of the abdomen, and immediately below it are the palp-like jointed protuberances through which the silk of the web is forced or drawn. These are in three or four pairs, and they are perforated at the ends with many small pores, to the number estimated at 1,000. We trust the reader has now a pretty clear idea of the outer form of the spider; and he cannot do better than verify the description by catching a spider,

killing it in hot water, and then examining it with a Coddington lens.

We proceed to describe the internal organs in detail. The mouth, situated between the jaws, leads to a throat which runs a short way backward, then bends sharply upward, and then again backward, in a horizontal position. From the outside of this last-named flexible horizontal portion, which opens into a globular stomach behind, muscles run to the inner wall of the shield, and thus provide the means of sucking up juices. The lower oval and depressed portion of the stomach sends from each of its sides five tubes, which bend upwards, and then enter an annular second stomach, which is situated above the other. A solid mass lies between the stomachs, and to this a muscle is attached, which passes through the central hole of the upper ring-like portion, to be attached to the dorsal shield above. This muscle not only suspends the stomach, but, by contracting and relaxing, causes the lower sac to work like a bellows, and so stirs its contents, driving them through the side tubes into the upper stomach, and this favours the functions of digestion and absorption. Almost the whole nutritive process is carried on in the stomach, for only a narrow prolongation of it is carried into the abdomen; and although this receives ducts from the liver-fat masses, yet it runs as a short straight narrow tube to the vent. Just before the exit, the intestine dilates into a roundish cavity, which is called the cloaca, and receives two ducts, one on each side, which are thought to be excreting organs to remove the azotised products of the breaking down of the tissues of the body. The ducts, three or four in number on each side, which enter the abdominal portion of the alimentary canal, proceed from the large masses of fatty substance which is collected into a mass of vesicles on either side of the bag-like hind segment. These masses may, therefore, represent the liver, but they no doubt also act as a store of nutriment laid up in the body. This arrangement would seem to be necessary on account of the precarious nature of the supply of food. These creatures, having to lie in wait for their prey, must be able to play a waiting game; and they manifest, by their fierceness when a stray victim falls into their toils, that they appreciate an opportunity which may be long before it is repeated.

A heart shaped like that of insects lies immediately under the skin of the back of the abdomen. It is divided into four chambers, placed in a longitudinal series, and propels the blood forwards. It is contained in a loose membranous investment, which is called the pericardium. This is a reservoir of the blood received from the system, and it passes from this outer court of the heart into its four compartments, through small valvular holes, one to each compartment. The large vessel given off in front passes into the cephalo-thorax, and there divides into three pairs of vessels. The top pair goes to the eyes and mouth organs, the middle pair to the stomach, and the lowest pair to the legs. The blood from these is collected again, and flows through a long central vessel running along the floor of the body right to the spinnerets, giving off vessels to the skin viscera, and also sending part of its supply of blood to the pulmonibranchiæ. After being distributed through the pulmonibranchiæ, the blood is collected into a number of vessels which run from these along the sides of the body, mounting upwards, and discharging themselves into the pericardium. The lung-bags contain a number of fine leaves which lie close together like the leaves of a book, and in these the blood is aerated.

The nervous system in the spider is so concentrated as almost to lose its homogaugliate character. A small double ganglion rests on the top of the throat, and sends cords to the eyes and jaws. This is connected by two cords, one on each side of the throat, to a large nervous star-shaped mass, which lies on the floor of the cephalo-thorax, and sends nerves to the legs, while from its hind part a thicker cord passes into the abdomen, and there splits into a number of small nerves which go to all parts of the viscera. The great star-shaped mass represents the whole chain of double ganglions, shortened, and compressed into one. It will be seen that this arrangement is very much like that of the nervous system of the short-tailed Crustacea, or crabs.

The glands of special secretion are of two kinds. The poison-glands lie in the cephalo-thorax, one on each side of the throat, and in the upper part of the mandibles. A duct from each gland passes to the point of the fang, and it conveys a liquid which acts as a rapid poison to insects.

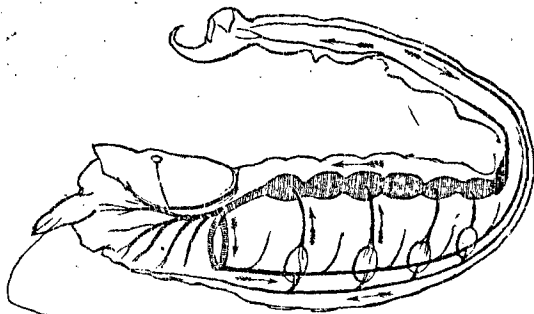
The silk-secreting organs found in the abdomen consist of a

great number of tubes, on which rounded clusters of follicles are found. These have also dilations in their course. All the tubes end in the spinneret, and the substance they secrete is a sticky liquid which is squeezed through the open pores at the ends of the external organs. It would seem that not only all the threads of each spinneret run together, but that all the strands so formed from all the spinnerets are united into one cord. As the thread is evolved, the spider usually grasps it with its two hind feet, which may be either to consolidate it or to draw it out. The sticky secretion of the web dries on exposure to the air. Perhaps, however, in the singular web of the Ciniflo the separate strands are not blended, for the web has this peculiarity—the lines are composed of one stout thread, encompassed by thinner lax lines, which twist in all directions.

All the spiders appear to be silk-spinners, but they do not all apply their arts to the fabrication of snares. Fully one-half of them confine their weaving to the construction of cocoons for their eggs, or for lining or making tubes and tunnels into which they can retreat. The little Salticus, which, dressed in a harlequin suit, courses over the upright walls that the hot summer sun shines upon, springs on its prey, first securing itself by a thread lest it should fall. Those spiders which' spin snares, do so according to very different methods. The *Agelenidae* spin loose, irregular webs over foliage, etc., that communicate with tubes in which the spider lies concealed. The *Linyphiidae* spin horizontal webs, and stand clinging to their under-sides, back downwards. The chief of all spinners are the *Epeiridae*. These spin vertical webs whose lines are all in one plane. The outer framework of these webs is necessarily irregular, because this is determined by the support on which it rests, but all within this is beautifully symmetrical. Lines radiating from a common centre pass to the cords of the frame, and on these is sustained a close-set spiral line, which runs continuously from centre to circumference, being attached to each radius as it passes them. These lines are very elastic, and will bear a good deal of strain. It is a peculiarity of these lines that they have on them, at regular intervals, beads of viscid matter, which does not dry in the air like the silk. A clew runs from the web to the neighbouring retreat where the spider hides; and this would seem to answer the double purpose of informing the spider when the snare is shaken by an entangled insect, and of affording it a way whereby at once to rush upon its victim. When the insect is powerful the spider will wait till both ends of the body are attached to the web, and then, striding over it, it will hold the cords of attachment tense with its wide hind-legs, touch the insect with its spinnerets, fix a thread to it, and then set it rapidly revolving with its fore-legs, until the insect is completely ensnathed in silk, like a mummy. The watch-box of the spider is usually under some leaf, but often it constructs a dome of silk to protect it from the rain, etc. A most remarkable instance of an animal formed for air-breathing, all of whose relatives live in air, having invaded the water, is found in the *Argyroseta aquatica*, which makes a dome under water, and then carries down air, which it places under its diving-bell.

The scorpion is the type of another group of Arachnida. This creature is much more elongated than the spider, and its segmentation is very much more distinct, the segmentation of the abdomen furnishing its distinguishing characteristic. The thoracic shield, which is supposed to represent the dorsal half, is of eight rings. About the centre of this are seen two eyes, one on each side, and close to the mid-line, while at the front outer angles groups of simple eyes are found. All the jaws and limbs are supposed to belong to these coalesced segments. The next eight segments of the back are as wide as the cephalo-thorax, while the succeeding six are very narrow, and capable of moving on one another by definite joints in an up-and-down direction. The last segment has a hooked spine with its point directed downwards. This is the instrument of attack, and it contains a gland from which poison is ejected in the wound it makes. Thus the sting, instead of being in the antennal jaw at the head end, as in the spider, is placed in the very hind-joint of the scorpion. The bases of the legs almost obliterate the under-segments or sterna of the fore-part of the body, but the succeeding ones are well represented, and through four of them the slits which lead into the eight pulmonibranchiæ are cut. Between the black horny back and front pieces of these segments is a white flexible membrane. In the six tail-pieces the top and bottom parts are united immovably together. The nature of the limbs is best

seen in the illustration. The small forceps in front would seem to correspond with the mandibles of spiders, and the large and long pincers to the maxillary palps, while the four pairs of succeeding legs represent the legs of spiders and the hind walking-legs of decapod crustaceans. Thus it would appear that the hind foot-jaws and first pair of walking-legs of crustaceans are absent. The stomach in the scorpion is much simpler than in the spider, and there is scarcely any distinction of parts. The heart has eight segments, and the hind one, not being situated further back than the broad part of the body, sends the blood backward by a vessel to the tail. Besides the ventral vessel, a sub-ganglionic or portal vessel exists, which drives the blood to the lungs. Perhaps the course of the blood can be gathered from the rough diagram below. It would take too long to de-



scribe it here. The nervous system consists of seven double ganglia besides the brain.

The mites have a smooth bag-like body, with a small head united with it. They breathe through tracheæ, whose entrance-orifices are situated on the under-side of the body. Some, however, have two exit-holes for the tracheal system, one on each side of the mouth, through which they expel the air derived through the other openings. The nervous system in these is said to consist of only one ganglion. These creatures often live on the bodies of other animals. The shield beetle has almost always a multitude of them clinging to its body in the grooves between the segments of its body underneath. The organs of the mouth in these are usually converted into sucking snouts, with points directed outwards, so as to secure the hold of the creature.

Two other orders of very low grade would seem to indicate that the spiders are related to the articulate type directly through the worms. In one of these the body is completely like a worm. These are internal parasites. The other order is represented by a creature which inhabits the skin-follicles of the human face, generally fixing on the nose as its habitat. This starts in life with a worm-like form, and gradually shortens into a mite-like animal. The orders are defined as follows:—

1. *Pantopoda*.—Arachnida, with the cephalo-thorax segmented into four pieces; a rudimentary abdomen, and long many-jointed legs; without true organs of respiration.

2. *Linguatulina*.—Wormlike Arachnida, having the habits of intestinal worms; with sexes distinct, and no apparent organs of respiration.

3. *Tardigrada*.—Hermaphrodite Arachnida, with stumpy legs, and without organs of respiration.

4. *Acarina*.—Arachnida, with biting or sucking mouths; an unjointed abdomen united to the cephalo-thorax; second feeler-jaws foot-shaped, with a tracheal system.

5. *Araneina*.—Arachnida, with biting jaws, stalked unsegmented abdomen; second pair of feeler-jaws shaped like feet, and with combined lungs and tracheæ.

6. *Arthrogastra*.—Arachnida, with a distinctly jointed abdomen, breathing by pulmonibranchia.

LESSONS IN LATIN.—XXXI.

DEPONENT VERBS (continued).

In our last lesson the learner was furnished with a model of a deponent verb of the second conjugation and a list of verbs to be written out according to the example given. This should be done frequently, in the case of all the parts of speech in Latin that suffer declension, if the student desire to become thoroughly

familiar with their formation. He should also write out from memory our remarks on the construction of *hortor*, *vereor*, etc., correcting his work by comparison with the original.

VOCABULARY.

Cito, quickly.	Inanis, -e, empty (E. R. inanity).	Nego, I deny.
Confiteor, 2, confessus sum, I admit, confess (E. R. confession).	Informo, I, I instruct.	Nondum, not as yet.
Cunctos, -a, -um, all unitedly, in opposition to omnis, which is, all severally.	Inopia, -æ, f., want.	Penitus, thoroughly.
Denuo (de novo), anew, again, lately.	Intueor, 2, I look on, contemplate (E. R. intuition).	Præsidium, -i, n., protection, support, assistance.
Detraho, 3, I take away.	Liberaliter, freely.	Profiteor, 2, professus sum, I profess, promise (E. R. profession).
Exemplar, -aris, n., a pattern, model.	Malitia, -æ, f., badness, baseness, malice.	Reor, 2 (rerī, rēctus sum), I am of opinion, think.
Impetro, 1, I obtain.	Medeor, 2 (no perfect), I heal, with the dative; that is, the object of this verb must be in the dative case.	Trado, tradere, tradidi, traditum, 3, I hand down, I give up (E. R. tradition).
Imploro, 1, I entreat (E. R. implore; ploro, I weep).	Mereor, I deserve, etc., is followed by de, as de aliquā re.	Venia, -æ, f., pardon, leave, permission.

Observe that the conjunction *quum* requires its verb to be in the subjunctive mood, when it denotes a cause or reason, and is rendered by *since* or *although*; *quum* is then said to have a causal force.

EXERCISE 110.—LATIN-ENGLISH.

1. Vix peccatum tuum fassus eras, quum pater tui misertus est. 2. Jam te crasse confessus eras, quum denuo negasti. 3. Nondum vestrum auxilium imploraveramus, quum jam id nobis professi estis. 4. Vix inopiam nostram fassi eramus, quum liberalissime vestrum præsidium nobis polliciti estis. 5. Magna vis est philosophia quum medetur animis, et inanes sollicitudines detrahit. 6. Artes magnum nobis præbent præsidium, quum seipsæ per se tuerentur singule. 7. Præclare de patris merentur præceptores, quum juventutem bonarum litterarum studiis informant. 8. Quam philosophia animis medetur ei totos nos penitusque tradere debemus. 9. Omnes miserabantur vestri, quum non propter malitiam sed propter fortunam in miseris esastis. 10. Quum milites pericula vererentur, non audebant cum hostibus conficere. 11. Avarus, quum sit divitissimus, non fatiscebat se satis habere. 12. Misere nostri; medemini, O cives, inopiam nostram. 13. Suum quisque tuetur filium. 14. Nemo, cunctam intuens terram, de divina providentia dubitabit. 15. Cives, hostes ursem oppugnatos rati, eos acriter propulsare studuerunt. 16. Venio meum præsidium tibi polliciturus. 17. Adolescentis officium est majores natu vereri. 18. Omnium modis vos inopiam civium mederi debetis. 19. Quis nescit te præclare de republica meritum esse? 20. Spero te mei miserturum esse.

EXERCISE 111.—ENGLISH-LATIN.

1. They confessed their sins. 2. They will confess their sins. 3. Will they have confessed their sins? 4. He will not confess his sins. 5. My sister has confessed her sins. 6. The young men deny that they will confess their sins (acc. case and infinit. fut.; drop the *that*; "deny that they will," is equal to say they will not, that is, *refuse*). 7. Religion heals men's minds. 8. True religion only can heal men's minds. 9. Religion has always healed the minds of the pious. 10. Pity me, O my father. 11. O God, pity us. 12. O God, pity all men. 13. Let every husband guard his wife. 14. The young men, thinking the soldiers about to attack their homes, slew themselves in fear (*being afraid*). 15. The arts severally protect artists (*artificers*). 16. Do the arts protect each other? 17. The arts have protected, do protect (present tense), and will protect artists. 18. Look at the heaven, and thou wilt fear God. 19. Contemplating virtue, men become wise. 20. He has served the republic well (*deserved well of the republic, de republica*). 21. The queen will serve the republic well. 22. The soldiers served their country well. 23. I am not able to serve my home well. 24. He contemplates a model of virtue. 25. He confesses his sins, and obtains pardon. 26. They have confessed their sins, and obtained pardon. 27. Since you have confessed your sins, you will obtain pardon.

Vereor denotes the reverence which arises from a sense of one's own infirmity, as compared with the high attributes of the object who calls forth the sentiment. *Vereor*, accordingly, is the root of reverence. *Vereri* denotes the feeling of children towards a parent. But when the sentiment of self-abasement rises into a fear of some evil from a superior power, or an oppressive consciousness of superior power over you, then the sentiment is expressed by *metuo*.

CONSTRUCTION OF "VEREOR."

Accusative of object; with *ne*; *ne non*; *non* and *ne*; with *ut*; infinitive as an object.

Note.—*Vereor ne* is used of things you do not desire.

Vereor ut is used of things you do desire.

Accusative of object:—"Metuebant eum servi, verebantur liberi."—Cicero.
Literal Translation:—"Feared him slaves, revered children."
Idiomatic Translation:—"His slaves feared, his children revered him."

With *ne*:—

"Vereor ne quasi præcipientis esse videatur oratio mea."—Cicero.
Lit. Trans.:—"I fear lest as if of one enjoining to be may appear speech my."

Id. Trans.:—"I fear lest my speech may appear like the speech of a master."

With *ne non*:—

"Veritus ne hostium impetum sustinere non posset."—Cæsar.
Lit. Trans.:—"Fearing lest of the enemies the attack to endure not could."

Id. Trans.:—"Fearing he should not be able to endure the attack of the enemy."

With *non ne*:—

"Non vereor ne aucupari tuam gratiam videar."—Cicero.
Lit. Trans.:—"I do not fear lest to court thy favour I may appear."
Id. Trans.:—"I do not fear of appearing to court thy favour."

With *ut*:—

"Illa duo vereor ut tibi passim concedere."—Cicero.
Lit. Trans.:—"These two things I fear that to thee I may be able to concede."

Id. Trans.:—"I fear I cannot concede these two things to thee."

Infinitive as an object:—

"Hei mihi! vereor dicere."—Terence.

Lit. Trans.:—"Alas to me! I fear to say."

Id. Trans.:—"Alas! I fear to say."

VOCABULARY.

Cognosco, 3, I know.	Incipio, 3, I begin (E. R. incipient).	Redditæ sunt, have been delivered.
Excido (ex and cædo), I cut off or down.	Intellego, 3, I understand.	Valeo, 2, I am strong.
Expleo, 2, I fill up, satisfy (E. R. expletive).	Introeo, 4, I enter.	I avail, prevail (E. R. valid).
Incedo, 3, I walk, walk abroad.	Ne ipsi quidem, not even they themselves.	Veteranus, -i, m., a veteran soldier.
	Recedo, 3, I return.	

EXERCISE 112.—LATIN-ENGLISH.

1. Quid veteranos non veremur? nam timere se ne ipsi quidem volunt. 2. Veremur vos, Romani, et si ita vultis, etiam timemus. 3. Ne illa vereatur introire in alienam domum. 4. Vereor magis me amoris causâ hoc ornatu incedere. 5. De Carthagine non ante vereri desinam, quam illam excisam esse cognovero. 6. Vereor ut Pollabellâ satis nobis prodere possit. 7. Accepi tuas literas, quibus intellexi te vereri ne superiores mihi redditæ non essent. 8. Ne ejus supplicio Divitiaci animus offenderet, verebatur. 9. Vereor, si res explicare incipiam, non vitam ejus enarrare, sed historiam videam scribere. 10. Non vereor ne scribendo te expleam. 11. Non vereor nequid timide, nequid stulte facias. 12. Non vereor ne meæ vitæ modestia parum valitura sit contra falsos rumores.

EXERCISE 113.—ENGLISH-LATIN.

1. They venerate their parents, and fear the king. 2. Tyrants are feared. 3. They will fear tyrants. 4. I shall fear my parents. 5. I do not fear that I shall fill (*satisfy*) you with words. 6. You fear to enter the enemy's camp. 7. I fear that I read without profit; they fear for (de) their country, lest it be destroyed. 8. I fear my mother will come. 9. Why do you fear that your mother will come? 10. Because I am acting (*I act*) against her commands. 11. They fear that their uncle is dead. 12. I fear that the wrath of God will fall on this city. 13. Thy life will prevail against calumny. 14. Do not fear that thy life will not prevail against the calumny of bad men. 15. Thou fearest that I am unable to do thee good. 16. Fear not that I shall do any foolish thing (*Latin, anything foolishly*). 17. My brother does not fear that I shall do any foolish thing.

It is very difficult to give in English an exact counterpart of some Latin forms. You will constantly have to make some little allowance for difference of idiom, though the sound scholar only can judge in particular instances whether a latitude is allowable or not.

In the preceding English-Latin Exercise I have written, "I do not fear that I shall satisfy you with words." Here, and in other parts of the exercise, the future "shall" and "will" are used in the English when the subjunctive present is required in the Latin. The subjunctive present could not be used in the English with a proper regard to idiom; nor could the future indicative be employed in the Latin. You have here one of those diversities of idiom with which you must become well acquainted, if you wish to be master of the Latin language.

Similar diversities would be found between any two other languages that you might compare together.

KEY TO EXERCISES IN LESSONS IN LATIN.

EXERCISE 108.—LATIN-ENGLISH.

1. Sabinius having encouraged his (troops), gives the signal. 2. Your benefits exhort me to obey your command. 3. Cæsar exhorted his soldiers to (strive after) glory. 4. They encouraged them to become friends (*towards joining friendship*). 5. I exhort you again and again concerning the same things on which I have exhorted you in a former letter. 6. We will not cease to advise Pompey to shun great dishonour. 7. He exhorts them not to fail in courage. 8. I then, fearful, advised shameful flight. 9. I, indeed, cease not to recommend peace.

EXERCISE 109.—ENGLISH-LATIN.

1. Magister ad diligentiam discipulos hortari non desinit. 2. Magister discipulos ad diligentiam hortabatur. 3. Magister discipulos ad diligentiam hortatus, omnibus oscula dedit. 4. Sapientia tua me hortatur ut imperio tuo paream. 5. Hortabitur eos in amicitiam Iungen-dam. 6. Pater tuus te liodem de rebus hortatur, quibus ego fratrem meum hortabor. 7. Hortor te ne animo deficias. 8. Sororem tuam hortati sunt, ne animo deficiat. 9. Pudendam fugam hortabor nunquam. 10. Bellum hortari non desinit.

LESSONS IN GEOGRAPHY.—XXXI.

CHIEF POLITICAL DIVISIONS OF ASIA.

The following table exhibits the principal political divisions of the continent of Asia, showing the capital or chief city in each country, and the river, etc., on which it stands; the approximate area in English square miles; the number of inhabitants, as far as it is possible to make any estimate without a periodical census as a basis; and the approximate number of persons resident, on an average, on each square mile:—

THE CHIEF DIVISIONS OF ASIA—THEIR CAPITALS, AREA, POPULATION, ETC.

States.	Capitals.	Rivers, etc., on which the Capitals stand.	Approximate Area in Square Miles.	Approximate No. of Population.	No. of Inhabitants to every Square Mile.
RUSSIA IN ASIA, INCLUDING SIBERIA, CAUCASIA, AND TURKESSTAN.	Tobolsk.	Irtish.	6,250,000	12,000,000	2
CHINESE EMPIRE.	Pekin.	Peiho.	4,000,000	400,000,000	100
TURKEY IN ASIA.	Smyrna.	Egean Sea.	730,000	17,500,000	24
ARABIA.	Mecca.	Inland.	1,200,000	8,500,000	7
PERSIA.	Teheran.	Inland.	636,000	8,000,000	13
AFGHANISTAN.	Cabool.	Cabool.	225,000	5,125,000	23
BELOCHISTAN.	Kelat.	Gundava.	160,000	480,000	3
BRITISH INDIA, INCLUDING NATIVE STATES.	Calcutta.	Hooghly.	1,486,300	253,000,000	170
JAPANESE EMPIRE.	Yedo.	Sea Coast.	147,650	36,000,000	243

From the above table it appears that Russia in Asia is the most thinly populated country in Asia, while Japan and British India are the most densely populated. The student, however, must remember that in point of fact China Proper, the most important section of the Chinese Empire, is the most densely populated part of Asia, containing a population estimated approximately at 385,000,000 to an area of about 1,700,000 square miles, which gives 226 as the average number of persons to each square mile. The average for the entire Chinese Empire is lowered by taking into consideration Chinese Tartary, or Thibet, and Mongolia and Mantchooria, which have but a scanty population in comparison with their area.

Siberia is divided into two parts, Eastern Siberia and Western Siberia. Each part is sub-divided into governments or provinces as follows:—

EASTERN SIBERIA.

Governments.	Chief Towns.	Governments.	Chief Towns.
Yeniseisk.	Yeniseisk.	Yakutsk.	Yakutsk.
Irkutsk.	Irkutsk.	Okhotsk.	Okhotsk.
Amoorsknja.	Blagoveshensk.	Kamtschatka.	Petrozavodsk.

WESTERN SIBERIA.

Governments.	Chief Towns.	Governments.	Chief Towns.
Tobolsk.	Tobolsk.	Semipalatinsk.	Semipalatinsk.
Tomsk.	Tomsk.	Turkestan.	

In addition to these must be named the territory south of the Caucasus, belonging to Russia, commonly called Transcaucasia. Of the above, the province or government of Amourskaja comprises the territory lately acquired by Russia from the Chinese Empire; while the new government of Turkestan, divided into the provinces of Semirotsensk and Syrdaria, includes the Kirghiz Steppes and the districts lately annexed in the north of Independent Tartary.

The Chinese Empire is divided into three parts: China Proper, in the south-east; Mongolia or Chinese Tartary, in the north; and Tibet, or Thibet, in the south-west. The capitals of these great divisions are respectively Peking, Ourga, and Lassa, but Peking is the metropolis and chief seat of government of the entire empire. The island of Hong-Kong, at the mouth of the Canton River, is a British dependency. Its chief town is Victoria. Macao, also in the Canton River, belongs to the Portuguese. The Chinese ports open to British commerce are Canton, Swatow, Foo-chow, Amoy, and Shanghai.

Turkestan, or Independent Tartary, is broken up into a number of petty states, called khanates, many of which are being gradually absorbed by Russia. Of these Bokhara, with its chief towns Bokhara and Samarcand, is the most important, while the khanates of Koondooz and Khokand occupy the second rank, all with chief towns of the same name.

The principal divisions of Turkey in Asia are Asia Minor, of which Smyrna is the capital, in the north-west; Syria and Palestine (chief towns, Damascus, Aleppo, and Jerusalem), in the south-west; Turkish Armenia (chief town, Trebizond), in the north-east; and Mesopotamia (chief towns, Bagdad and Diarbekr), in the south-east.

Arabia, like Turkestan, is divided into a number of states, some independent, and comprising a number of small districts, subject to Arab chieftains, as Yemen, Hadramaut, Lachsa, and Nejd; and others nominally tributary to a foreign ruler, as Arabia Petraea, and Hedjaz, which are considered as subject to Turkey; and Oman, which is under the control of the Imam of Muscat. In Hedjaz are the towns Mecca and Medina, famous, the former for being the birth-place, the latter the burial-place of Mahomet, the founder of the Mahometan religion. In Yemen, on the Red Sea, is Mocha, which gives its name to the delicious coffee grown in the surrounding districts; and at its southern extremity Aden, a British seaport, taken from the Arabs in 1839, and serving as a convenient coal depot for steamers plying between India and Suez, at the north-western extremity of the Red Sea.

Persia is divided into a number of provinces, of which it is difficult to give a list that may be relied on for correctness. Part of the country is occupied by wandering tribes under sheikhs, who are nearly independent, but pay a yearly tribute to the sovereign or shah of Persia, who maintains a standing army, equipped and disciplined after the European fashion.

The principal sub-divisions of Afghanistan are Cabool, Candahar, and Herat, each taking its name from its chief town. Seistan, a district in the western part of the country, is occupied by a number of semi-independent tribes, who are supposed to be under the control of the ruler of Herat. Beloochistan is divided into a number of provinces, each governed by its own chief. Those forming the western half of the country are independent, but those in the east owe a nominal allegiance to the Khan of Kelat, the most powerful of the petty princes of Beloochistan.

The greater part of the peninsula of Hindostan consists of territory absolutely belonging to the British Empire, and states governed by native princes under British protection. The only states that are really independent of British control are as follows:—Cashmere, in the north; and Nepal and Bhotan, on the north-east frontier, forming for the most part the southern slopes of the great Himalaya range. The remainder is divided into five districts called presidencies, each under a lieutenant-governor, except the presidency of Bengal, the presidency immediately under the control of the Viceroy of India, to whom the lieutenant-governors of the remaining provinces are subject.

The five presidencies are those of Bengal, North-West Provinces, Punjab, Bombay, and Madras.

The presidency of Bengal is on the east side of India, and comprises the whole of the fertile plain watered by the Sanpo or Brahmapootra, and the lower parts of the Ganges. The British dependencies east of the Ganges and in Further India—namely, Aracan, Pegu, Tenasserim, Malacca, and Singapore—are now included in this presidency. The chief town is Calcutta.

The presidency of the North-West Provinces (or, as this district should be called from its position, the North Central Provinces) lies in the centre of the northern part of Hindostan, and comprises Oude and a number of provinces to the south and west of it, stretching up to the borders of Cashmere and the Punjab. Agra is the chief town and seat of government.

The Punjab occupies the north-western corner of Hindostan, and lies to the south-west of Cashmere. The word Punjab means the plain or country of the five rivers, so called because it is watered by the Sutlej, Beas, Chenab, Jelum, and Ravee. The chief town of this presidency is Lahore.

Bombay, which includes Scinde, extends along the south-western coast of the peninsula from Kurrachee to Goa. The presidency takes its name from its chief town, Bombay.

The southern extremity of the peninsula, and the whole of the south-east coast, and the countries bordering on it, form the presidency of Madras, which also takes its name from its chief town. The fine island of Ceylon, at the south of the peninsula, is a dependency of this presidency.

The principal protected states, governed by native princes in strict alliance with, and under the control of, the British Crown, are as follows:—

Sikhim.	Orissa.	Malwa.	Goojerat.
Cooch-Bihar.	Hyderabad.	Bhopal.	Cutch.
Munseepoor.	Mysore.	Ludore.	Bahawalpoor.
Silhet.	Travancore.	Rajpootana.	Sikh States.
Bundelcund.	Kolapoor.	Bhurtpoor.	

The French and Portuguese still retain a slight footing in the peninsula, the former holding Pondicherry on the Coromandel Coast, and Chandernagore on the Hooghly; while the latter possess Panjam and Goa on the south-west coast.

Further India, or India beyond the Ganges, comprises the states of Burmah, Siam, and Laos, in the centre of the peninsula, lying between the British possessions on the west coast and Anam on the east. The Malay Peninsula is partly occupied by independent tribes, or tribes which owe a nominal allegiance to Siam. The French have acquired a large territory in the south-east of the peninsula, consisting of the southern provinces of Siam and Anam. The chief of the French settlements in this district is Saigon on the river Dong-Nai.

The Japanese Empire is composed of a chain of large islands, extending in the form of a crescent from the southern extremity of the island of Saghalien, half of which is claimed by the Japanese, to the peninsula of Corea. The chief of these islands are Nippon, Sikoke, Yesso, and Kinsiu. The capital is Jeddo, or Yedo, on the island of Nippon. The principal ports open to British commerce in Japan are Hakodadi, Négata, Kana-gawa, Hiogo, and Nagasaki.

READINGS IN GERMAN.—VI.

6.—Die Pfirsichen.
Des pfir-zly-jen.

Ein Landmann brachte aus der Stadt fünf Pfirsichen mit, die in ein laut-man brach-tai ouss dair shtat fünf pfir-zly-jen mit, des schünsten, die man sehen konnte. Seine Kinder aber sahen shö'n-sten, des man zey'-hen kö'n-tai. Zi'-nai kin'-der ah'-ber zah'-hen diese Frucht zum ersten mal. Deshalb wunterten und des'-zai fröcht-tödm eyr'-sten mahl. Des'-halb wö'n-der-ten önt freuten sie sich sehr über die schönen Pfirsich mit den rötlichen fröi'-ten zee zly zeyr u'-ber des shö'-nen ep'-fel mit dair röt'-ly-jen. Baden und garten Pfraum. Darauf verteilte sie der back'-en önt tsahr'-tem pfraum. Dah-rouf ferr-tib'-tai zee dair Vater unter seine vier Knaben, und eine erhielt die fah'-ter öon'-ter zi'-nai feer knah'-ben, önt i'-nai err-heelt die Mutter. mööt'-ter.

Am Abend, als die Kinder in das Schlafkammerlein gingen, Am ah'-bent, als des kin'-der in dass shlahf'-kem'-mer-line ging'-en, fragte der Vater: Nun wie haben euch die schönen Pfirsich frach'-tai dair fah'-ter: Noon wie bah'-ben ey dees shö'-nen ep'-fel ge'-schmeckt? Herrlich, lieber Vater, sagte der Pfirsiche. gah'-shmeckt? Herrlich, lieber Vater, sagte der Pfirsiche. Es ist eine schöne Frucht, so süßlich und so sanft von Ess ist i'-nai shö'-nai fröcht, so zoi'-er-ly önt so zant son ge'-schmeckt. Ich habe mir ein Stein gefangen bewahrt, gah'-shmeckt. Ich habe mir ein Stein gefangen bewahrt, und will mir daraus einen Baum erziehen. önt vill meer dah-rouss i'-nen boum err-tsee'-hen.

Brav! sagte der Vater, das heißt haushälterisch auch Brav! zah'-tai dair fah'-ter, dass hist house'-hel-tai-rish auch für die Zukunft gefügt, wie es dem Landmann geziem. für des tsoo'-könnst gah'-zöy't, ves ess dem laut-man gah'-tsoem't.

Ich habe die Pfirsiche sorgfältig aufbewahrt, rief der ly hah'-bai des mi'-ri-gai zo-gli'y' auf'-gah'-ghoss'-sen, reef dair Jüngste, und den Stein fortgeworfen, und die Mutter hat yunk'-stai, önt dair shite fort'-gai-vör'-sen, önt des mööt'-ter hat mir die Hälfte von der Pfirsichen gegeben. O! das schmeckt meer des helf'-tai son dair es'-ri-ghen gah'-ghey'-ben. Oh! dass shmeckt-tai so süß und so schmeißt einem im Mund. zo züs önt tser-shmiltz i'-nem im möön'-dai.

Nun, sagte der Vater, du hast gar nicht sehr klug. Noon, zah'-tai dair fah'-ter, doo hast tsavahr nlyt zeyr klooch, aber noch natürlich und nach künftlicher Weise gehalten. ah'-ber öch na-tü'-ly önt nah'-ly kint'-ly-jer vi'-zai gah'-han'-delt. Für die Klugheit ist auch noch Raum genug im Leben. Für des klooch'-hite ist auch noch roum gah'-nooch im ley'-ben.

Da begann der zweite Sohn: Ich habe den Stein, den Dah bai-gan dair tsai'-tai zo'n: Ich habe den Stein, den der kleine Bruder fortwarf, gesammelt und aufbewahrt. dair kli'-nai broo'-der fört'-vart, gah'-zai-melt önt auf'-gai-klooft.

Es war ein Kern darin, der schmeckt so süß wie eine Ess vahr ine kern da-rin, deyr schmeckt-tai zo züs ves i'-nai Pfirsich; aber meine Pfirsiche habe ich verkauft, und so viel wöss; ah'-ber mi'-nai pfir'-zly hah'-bai ly ferr-kouft, önt so veel öch dafür erhalten, daß ich, wenn ich nach der Stadt komme, gelt da-für err-hal'-ten, dass ly, von ly nah'-ly dair shtat köm'-mai, wohl profit dafür laufen kann. voel tsövl da-für kou'-len kan.

Der Vater schüttelte den Kopf und sagte: Klug ist das Dair fah'-ter shat'-tel-tai dair köpf önt zah'-tai: klooch ist dass wohl, aber kintlich und natürlich ist es nicht. Bewahre dich voh, ah'-ber kint'-ly önt na-tü'-ly ist ess nlyt. Bai-vah'-rai diy der Himmel, daß du kein Kaufmann werdest. dair him'-mel, dass doo kine kouf'-mann veyr'-dest.

Und du, Edmund? fragte der Vater. Unbefangen und önt doo, ed-möont? frach'-tai dair fah'-ter. öon'-bai-fang'-en önt offen antwortete Edmund: Ich habe meine Pfirsiche dem M-fen ant-vör-tai-tai ed-möont: Ich habe meine Pfirsiche dem Sohn unseers Nachbarn, dem kranken Georg, der das Fieber zo'n ööit-zerss nach'-bahrs, dair kran'-ken gah'-ory, deyr dass feo'-ber hat, gebracht. Er wollte sie nicht nehmen. Da hab ich sie hat, gah'-brach't. Eyr völl'-tai zee nlyt ney'-men. Dah hahb ly zee ihm auf das Bett gelegt und ein Kissen gegeben. önt auf dass bet gah'-leyt önt ein hin-vey'-gah'-gang'-en.

Nun, sagte der Vater, mer hat denn wohl den besten Gebrauch von seiner Pfirsiche gemacht? brach'-tai dair fah'-ter, mer hat denn wohl den besten Gebrauch von seiner Pfirsiche gemacht? brach'-tai dair fah'-ter, mer hat denn wohl den besten Gebrauch von seiner Pfirsiche gemacht?

Da riefen sie alle drei: Das hat Bruder Edmund gethan! Dah reo'-fen zee al'-lai dry: dass hat broo'-der ed-möont gah'-tahn! Edmund aber schweig still, und die Mutter umarmte ihn Ed-möont ah'-ber shwey'-sthill, önt des mööt'-ter öm-arm'-tai een mit einer Thräne im Auge. mit i'-ner trey'-nai im ey'-gai.

VOCABULARY.

Pfirsich, f. peach.	Erziehen, to bring up, to educate.	Weise, f. manner.
Stadt, f. town, city.	Brav, bravo, good.	Raum, m. room.
Fünf, five.	Das heißt gefügt für "on."	Sohn, m. son.
Man, one; French, "on."	that may be called, to take care of	Auffheben, to open.
Frucht, f. fruit.	(auf, preposition and prefix, open, up, upon, on.)	
Erst, first.	(heßen, to be called, command.)	Arn, m. kernel.
Deshalb, therefore.	Haushälterisch, economically. (halten, to hold, to keep.)	Ruß, f. nut.
Apfel, m. apple.	Zukunft, f. futuro.	Verkaufen, to sell.
Röthlich, reddish.	Geheimen, to behave.	Geld, n. money.
Wade, f. cheek.	Minige, ter, die, tas, mine.	Nach, to, after.
Art, tender, delicate.	Egglisch, immediately.	Schütteln, to shake.
Pfraum, m. down.	Jung, young.	Kopf, m. head.
Vertheilen, to distribute, divide. (Theil, m. share, part.)	Werfen, to throw; fort, away.	Natur, f. nature.
Bier, four.	Süß, f. half.	Simmel, m. heaven.
Erhalten, to obtain, to receive, to preserve.	Spige, ter, die, tas, hers, theirs, yours.	Kaufmann, m. merchant. (Kann, m. man [Lat. vir.])
Gefallen, to taste.	Glücklich, glorious, -ly.	Befangen, embar-rassed.
Ältest, eldest. (Alt, old.)	Süß, sweet.	Offen, open, -ly.
Säuerlich, tart. (Sauer, sour.)	Schmecken, to melt; zu, prefix, to pieces, indicating separation.	Nachbar, m. neighbor.
Sanft, soft, mild.	Smart, it is true, indeed.	Wieder, n. fever.
Gefühls, m. taste.	Klug, shrewd, clever.	Setzen, to put, place.
Stein, m. stone.	Heiß, affix, corresponds -ful.)	Singeg, weg, away.
Sorgsam, carefully. (-sam, affix, -some, -ful.)	Woh, -ness, -head, -hood.	Gebrauch, m. use, custom.
Baum, m. tree.		Drei, three.

LESSONS IN ARCHITECTURE.—XIV.

CHURCH ARCHITECTURE.—II.

In our previous paper we have traced the rise of church architecture from its earliest commencement, in the style of the civil architecture of the Romans, to its elaborate development in the various forms of the Gothic. The illustrations already given will have afforded our readers an idea of the general features of the chief styles in use in this country in earlier times. We have now to mention some of the details which characterize the architecture of the several periods, and to glance at the internal arrangements of our church buildings when church architecture had reached its highest stages.

First, as to the materials used. There is no doubt that in our earliest churches, as in those of the Continent, fragments of Roman masonry were turned largely to account. This masonry generally consisted of stone or flint embedded in mortar, and bound at frequent intervals with layers of red tiles. Walls of this character, the remains of old Roman work, are found in various parts of Britain. In some of the very oldest of our churches materials identical in their nature are discovered, but without the regular courses of tiles observed in the Roman masonry. An instance of this is found in the restored church within the walls of Dover Castle, believed to have been built about the year 650. Close by it stand the remains of a tower undoubtedly Roman, in which the characteristic tile-courses are distinctly visible.

Many of the ancient churches of Kent and elsewhere in England are built of flint embedded in concrete, forming particularly solid and durable walls, which have stood and are likely to stand for ages. One of the oldest of these churches is St. Martin's, at Canterbury, which is believed to have been rebuilt in the twelfth or thirteenth century with the materials of a more ancient structure—perhaps the very earliest erected in Britain.

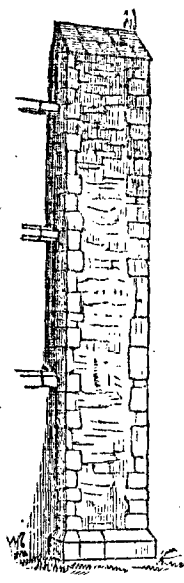
Some of the Anglo-Saxon churches were built of rubble, bound together at the angles with hewn stone, as in the case of the tower at Earl's Barton. The Normans largely used the same materials, but also employed small stones cemented together by mortar, which was poured in hot, and used larger blocks of stone for more important buildings. Sometimes

narrow stones were placed in regular courses, at an angle of about 45 degrees, the stone in each layer sloping in a different direction; and to this mode of building the name of "herring-bone work" has been applied.

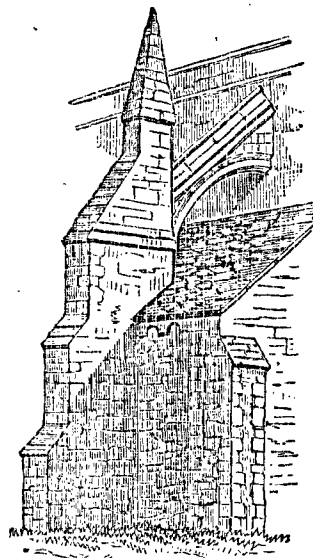
In the reign of Henry I. more attention began to be paid to the external appearance of the walls, which were now often built of stones squared or smoothed on the outer surface, and finely jointed together.

With the introduction and development of Gothic architecture, the softer stone called freestone came to be more and more employed to supplement the brick or hard stone used as the chief material of the fabric. The use of freestone was rendered both necessary and advantageous by the more regular and refined ornamentation which the Gothic style introduced; and by degrees the Middle-age builders moulded it to the freest expression of their ideas, whether those ideas were purely beautiful or simply grotesque and fantastic.

The solid masonry of the Anglo-Saxon and Norman walls required little or no external support, but the lighter character of the walls in Gothic buildings led to the development of the *buttress*. The early Norman buttresses were flat projections from the outer wall. As Gothic structures came in vogue, these projections were carried farther out, and sometimes rose tier above tier, until the highest and narrowest range terminated in a pinnacle. Moreover, when the upper storey of the building was much narrower than the base, it was supported by a buttress of its own, which rose from the buttress of the lower storey in the form of the segment of an arch. To these



NORMAN BUTTRESS.

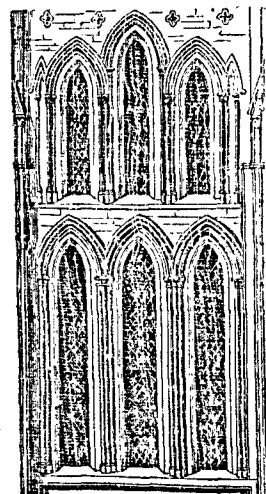


GOTHIC AND FLYING BUTTRESSES.

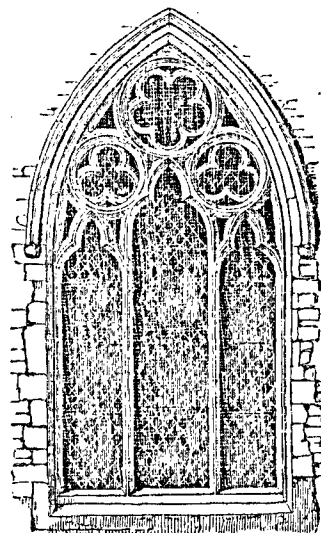
marks of the various periods of Gothic architecture. In the Norman buildings they were small and deeply recessed, while they presented the characteristic form of the semi-circular or segmental arch. The pointed or lancet-shaped window came in with the Gothic style—being, in fact, an adaptation of the Gothic arch—although at first, like the Norman windows, it was extremely narrow. The defect in the admission of an imperfect light was remedied by placing two or three of such windows side by side, thus forming one more useful in character and imposing in appearance. The glazing of church windows appears to have been introduced in the seventh century. The use of painted or stained glass came in with Gothic architecture, its purpose being to subdue and mellow the greater light admitted by the Gothic windows. The lancet-shaped windows of the "Early English" style are illustrated in the first cut below. But these plain windows were often accompanied, in large buildings, by others of a circular shape, known as "Catherine Wheel" windows, which were highly ornamented.

The general plainness and simplicity of the Early English period gave place, in the "Decorated" style, to a refined and elegant manner of ornamentation. Among other peculiarities, the window was widened, and its upper portion was filled with geometrical tracery, varied in character, and often of great beauty. A good example of the windows of the "Decorated Gothic" period is included in our engravings.

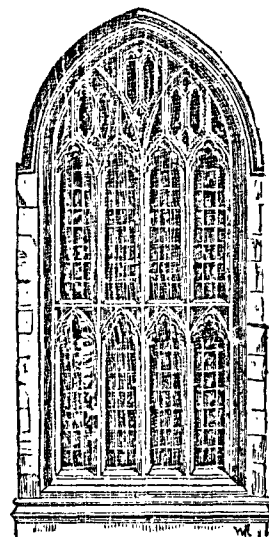
The "Perpendicular" style shows less purity of taste, but is



"EARLY ENGLISH" WINDOWS.



"DECORATED GOTHIC" WINDOW.



"PERPENDICULAR GOTHIC" WINDOW.

offshoots of the lower buttress the name of "flying" buttresses is applied, and they may be observed in many of our principal church edifices, such as Westminster Abbey. The earlier and the later forms of the buttress are shown in the illustrations on this page.

The windows are the most striking and distinguishing external

frequently productive of very rich effect. Our cut represents one of the most elegant of the windows of this period. The mullions, or divisions between the window-lights, here run up in perpendicular sections, instead of, as in the preceding style, branching off into geometrical figures; and this is one of the distinguishing features which have caused the name

of "Perpendicular" to be given to the architecture of this period.

An additional characteristic of the different styles will be found in the nature of the smaller details of ornamentation, such as the figures introduced in mouldings, etc. We give examples of the "tooth ornament" of the Early English Period, the four-leaved flower of the Decorated style, and the "Tudor flower" of that known as the Perpendicular. In the latter we see a degeneration into fanciful and extravagant forms, which, extending to all features alike, by degrees vitiated the Gothic style, and did much to bring it into disrepute at a later date.

We now come to the internal arrangement of churches, which was not affected materially by the introduction of the Gothic style.

We have alluded in our first paper to the early adoption of the form of the cross, and its general prevalence in the ground-plan of church buildings; and this necessarily gave a certain degree of uniformity in general design. We may take, as an example of general ground-plan, one of our oldest religious edifices of importance, the collegiate church of Wimborne Minster, in Dorset, believed to have been founded in the eighth century, and which bears in

larger church buildings, such as that of Wimborne Minster, are termed the *aisles*. Westward of the nave is usually placed the principal entrance, frequently surmounted by a tower. (See plan, A.) Other entrances are situated on the south or the north side, according to convenience of access, as in B.

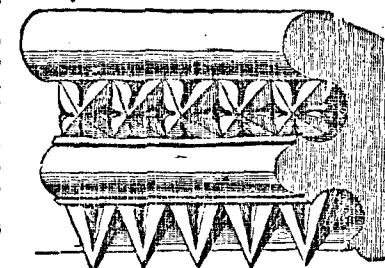
The form of the cross is given by the arms thrown out from the nave, usually at a distance of about two-thirds of the length of the edifice. These arms, running north and south, are called the *transepts*, and the chief tower or steeple of the building usually surmounts this intersection of its two principal lines.

The continuation of the building parallel with the nave, and eastward of the transepts, is chiefly occupied by the *chancel*, wherein the altar occupies the most prominent place. The chancel in the plan has

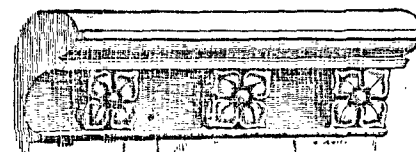
its aisles, like the nave; and its central portion westward is occupied by the *choir*. This space, as the name implies, is devoted in part to the choristers, but is often large enough to be used as a chapel, in which the wor-

shippers are assembled when not sufficiently numerous to occupy the main body of the edifice—i.e., the nave and its aisles.

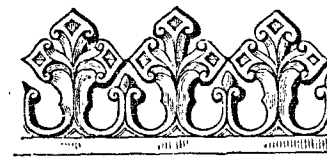
The chancel is the most richly-decorated portion of the interior



"EARLY ENGLISH" ORNAMENT.



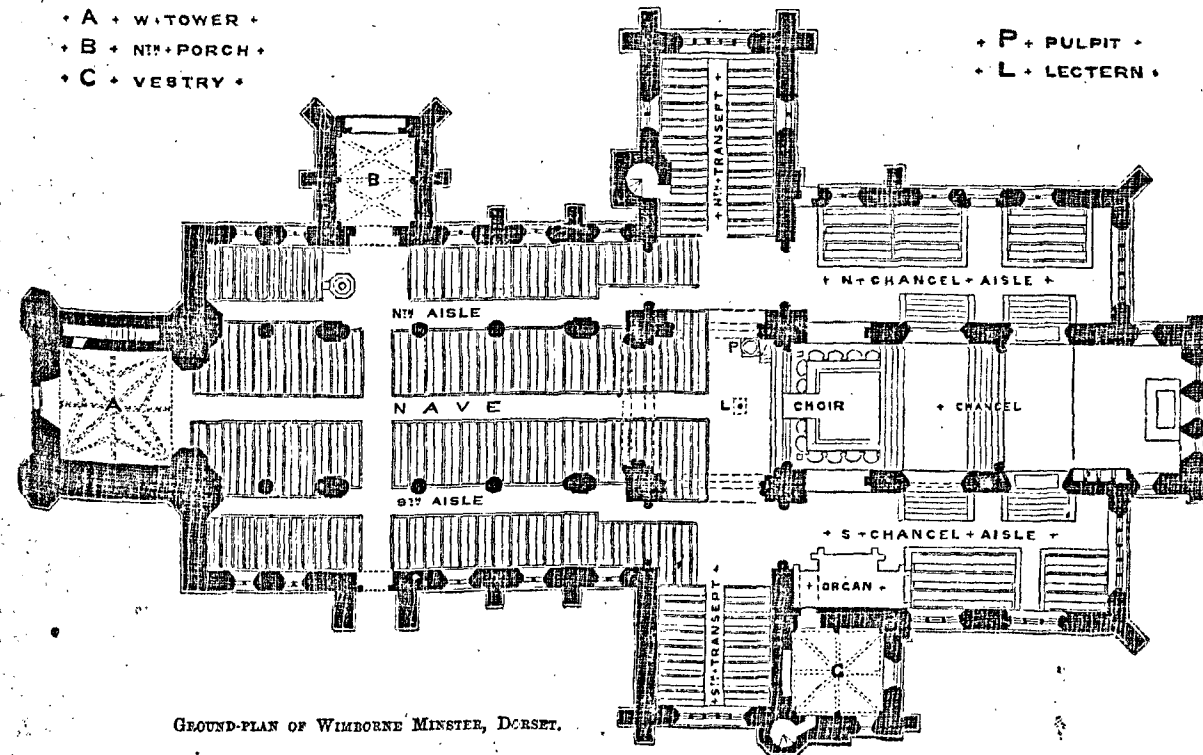
ORNAMENT OF THE "DECORATED GOTHIC."



"PERPENDICULAR GOTHIC" ORNAMENT.

- A + W. TOWER •
- B + N. PORCH •
- C + VESTRY •

- P + PULPIT •
- L + LECTERN •



GROUND-PLAN OF WIMBORNE MINSTER, DORSET.

its architectural features a combination of the Saxon, the Norman, and the Gothic, as different portions were erected at different times.

The body of the church throughout the greater portion of its length is called the *nave*, and the side passages found in the

of the edifice. The altar, which occupies its extreme end, is often lavishly embellished, and in Continental churches and cathedrals the masterpieces of the greatest painters frequently adorn this portion of the building. The flooring of that part of the chancel which contains and adjoins the altar is usually raised

and railed off, while sometimes this part is separated from the rest of the building by a handsome carved screen. In parish churches the chancel, consisting only of the central portion here marked in the ground-plan, often terminates in a semi-circular recess called the apse, which is occupied by the altar.

The *lectern* (L in the plan), situated almost in the centre of the transept in this instance, as in some others, is the place from which the lessons are read; and the letter P marks the position of the pulpit. It must, however, be noticed that in cathedrals, where the service is almost invariably performed in the chapel (the position of which is marked in our present ground-plan by the "choir"), the pulpit and lectern are often placed in the chancel, near the spot marked thus +.

The division marked C, which to a certain extent mars the symmetrical arrangement of the ground-plan, is for convenience sake commonly occupied either, as in this case, by the vestry, or by a chapter-house. Here, also, are frequently found the *cloisters*, or covered ways which in olden times were used for the purpose of exercise by the persons engaged in the service of the church.

LESSONS IN ALGEBRA.—VII.

DIVISION.

ART. 91. (1.) A man divided 48 apples among 6 boys. How many did each receive?

Here, if 6 boys receive 48 apples, it is manifest that 1 boy will receive $\frac{1}{6}$ of 48 apples; but $\frac{1}{6}$ of 48 = 8 apples; for $48 \div 6 = 8$. Whence 8 apples is the answer.

(2.) If 8 hats cost 24s shillings, what will 1 hat cost?

Here, reasoning as before, 1 hat will cost $\frac{1}{8}$ of 24s shillings, but $24 \div 8 = 3$; therefore 3s shillings is the answer.

The process followed in these examples is called *DIVISION*. It consists in finding how many times one quantity contains another, and is the reverse of multiplication. The quantity to be divided is called the *dividend*; the given factor, the *divisor*; and that which is required, the *quotient*.

92. *DIVISION*, therefore, is finding a quotient, which multiplied into the divisor will produce the dividend. As the product of the divisor and quotient is equal to the dividend, the quotient may be found by resolving the dividend into two such factors, that one of them shall be the divisor. The other will, of course, be the quotient.

Suppose, for instance, that abd is to be divided by a . The factors a and bd will produce the dividend. The first of these, being a divisor, may be set aside as the one factor. The other factor is the quotient.

93. When the divisor therefore is found as a factor in the dividend, the division is performed by cancelling this factor.

EXAMPLES.—(1.) Divide cx by c . Ans. x .

(2.) Divide dh by d . Ans. h .

(3.) Divide drr by dr . Ans. r .

(4.) Divide hmy by hm . Ans. y .

(5.) Divide $dhxy$ by dy . Ans. hx .

94. *PROOF*.—Multiply the divisor and the quotient together, and the product will be equal to the dividend, if the work is right.

Thus $ax \div a$ gives the quotient x . *Proof*. Here $x \times a$ gives the dividend ax .

95. If a letter is repeated in the dividend, care must be taken that the factor which is rejected be only equal to the divisor.

EXAMPLES.—(1.) Divide aab by a . Ans. ab .

(2.) Divide bba by b . Ans. ba .

(3.) Divide $aaddx$ by ad . Ans. $addx$.

(4.) Divide $aammyy$ by am . Ans. amy .

(5.) Divide $aaaxzx$ by $aaax$. Ans. zx .

(6.) Divide yyy by y . Ans. y .

In such instances as the preceding, it is obvious that we are not to reject every letter in the dividend which is the same with one in the divisor.

96. If the dividend consists of any factors whatever, expunging one of them is dividing by that factor.

EXAMPLES.—(1.) Divide $a(b+d)$ by a . Ans. $b+d$.

(2.) Divide $a(b+d)$ by $b+d$. Ans. a .

(3.) Divide $(b+a)(c+d)$ by $b+a$. Ans. $c+d$.

(4.) Divide $(b+y) \times (d-h)$ by $d-h$. Ans. $(b+y)$.

97. If there are numeral co-efficients prefixed to the letters, the co-efficients of the dividend must be divided by the co-efficients of the divisor.

EXAMPLES.—(1.) Divide $6ab$ by $2b$. Ans. $3a$.

(2.) Divide $16dxy$ by $4dx$. Ans. $4y$.

(3.) Divide $25dhr$ by $5h$. Ans. $5dr$.

(4.) Divide $12xy$ by 3 . Ans. $4xy$.

(5.) Divide $34drr$ by 34 . Ans. drr .

(6.) Divide $20hm$ by m . Ans. $20h$.

98. When a simple factor is multiplied into a compound one, the former enters into every term of the latter. [Art. 76.] Thus a into $b+d$, is $ab+ad$. Such a product is easily resolved again into its original factors. Thus $ab+ad = a \times (b+d)$.

EXAMPLES.—(1.) Resolve $ab+ac+ah$ into its factors.

Here $ab+ac+ah = a \times (b+c+h)$. Ans.

(2.) Resolve $c^2n+c^2dx+c^2y^2$ into its factors. Ans. $c^2 \times (n+dx+y^2)$ or $c^2(n+dx+y^2)$.

(3.) Resolve $bd+b^2cd^2+bc^2d$ into its several factors. Ans. $bd(1+bcd+c^2)$.

(4.) What are the factors of $amh+amx+amy$? Ans. $am(h+x+y)$.

(5.) What are the factors of $4ad+8ah+12am+4ay$? Ans. $4a(d+2h+3m+y)$.

In these examples, if the whole quantity be divided by one of the factors, according to Art. 96, the quotient will be the other factor.

Divide $(ab+ad)$ by a .

Here $ab+ad \div a = b+d$. Ans.

Divide $ab+ad$ by $b+d$.

Here $(ab+ad) \div (b+d) = a$. Ans.

Hence, if the divisor is contained in every term of a compound dividend, it must be cancelled in each.

(6.) Divide $ab+ac$ by a . Ans. $b+c$.

(7.) Divide $bah+bay$ by b . Ans. $ah+ay$.

(8.) Divide $aah+ay$ by a . Ans. $ah+y$.

(9.) Divide $drr+dhr+dxy$ by dr . Ans. $r+h+y$.

(10.) Divide $6ab+12ac$ by $3a$. Ans. $2b+4c$.

(11.) Divide $10drr+16d$ by $2d$. Ans. $5rr+8$.

(12.) Divide $12hx+8$ by 4 . Ans. $3hx+2$.

(13.) Divide $35dm+14dx$ by $7d$. Ans. $5m+2x$.

99. On the other hand, if a compound expression, containing any factor in every term, be divided by the other quantities connected by their signs, the quotient will be that factor. [See Art. 98.]

EXAMPLES.—(1.) Divide $ab+ac+ah$ by $b+c+h$. Ans. a .

(2.) Divide $amh+amx+amy$ by $h+x+y$. Ans. am .

(3.) Divide $4ab+8ay$ by $b+2y$. Ans. $4a$.

(4.) Divide $ahm+ahy$ by $m+y$. Ans. ah .

100. In division, as well as in multiplication, the caution must be observed, not to confound terms with factors. [See Art. 76.]

EXAMPLES.—(1.) Divide $(ab+ac)$ by a .

Here $(ab+ac) \div a = b+c$ by Art. 98.

(2.) Divide $(ab \times ac)$ by a .

Here $(ab \times ac) \div a = abc \div a = bc$ by Art. 95.

(3.) What is the quotient of $(ab+ac) \div (b+c)$? Ans. a .

(4.) What is the quotient of $ab \times ac \div (b \times c)$? Ans. aa .

RULE FOR SIGNS IN THE QUOTIENT.

101. In division, the same rule is to be observed respecting the signs as in multiplication; that is, if the divisor and dividend are both positive, or both negative, the quotient must be positive: if one is positive and the other negative, the quotient must be negative. [Art. 82.]

This is manifest from the consideration that the product of the divisor and quotient must be the same as the dividend.

For if $+a \times +b = +ab$, then $+ab \div +b = +a$;

If $-a \times +b = -ab$, then $-ab \div +b = -a$;

If $+a \times -b = -ab$, then $-ab \div -b = +a$;

And if $-a \times -b = +ab$, then $+ab \div -b = -a$.

EXAMPLES.—(1.) Divide abx by $-a$. Ans. $-bx$.

(2.) Divide $8a-10ay$ by $-2a$. Ans. $5y-4$.

(3.) Divide $3ax-6ay$ by $3a$. Ans. $x-2y$.

(4.) Divide $6am \times dh$ by $-2a$. Ans. $-3mdh$.

102. If the letters of the divisor are not to be found in the dividend, the division is expressed by writing the divisor under the dividend in the form of a vulgar fraction.

NOTE.—This is a method of denoting division, rather than an

LESSONS IN FRENCH.—XLV.

SECTION XCIX. [§ 130, 131.]—PRACTICAL SUMMARY OF THE RULES OF THE PAST PARTICIPLE.—I.

THE participle past is VARIABLE under any of the following conditions:—

1. When employed as an adjective; in which case it agrees in gender and number with the noun which it qualifies, after which it is always placed:—

Des livres imprimés. Printed books.
Ces femmes paraissent bien abattues. Those women appear very dejected.

2. When used in the formation of the tenses of passive verbs; in which it always agrees with the subject:—

Elles sont bien reçues de tout le monde. They are well received by everybody.

3. When employed in forming the compound tenses of neuter verbs having être as an auxiliary; in which instance, as in the preceding case, it agrees with the subject:—

Votre sœur est partie ce matin. Your sister went away this morning.

4. When employed in forming the tenses of active verbs having avoir as an auxiliary; in which connection it agrees not with the subject, but with the direct object, provided that object precedes the auxiliary:—

Les maisons que nous avons achetées. The houses which we have bought.

5. When used along with être in the formation of the compound tenses of pronominal reflexive verbs, wherein the reflexive pronoun is the direct object; in which position it agrees with that pronoun or direct object:—

Ces dames se sont flattées. Those ladies have flattered themselves.

6. When used along with être (as in Rule 5) in the formation of the compound tenses of reciprocal and reflexive verbs, in which the reflexive pronoun is not the direct, but the indirect object; in which event it agrees with the direct object, provided (as in Rule 4) that object precedes the auxiliary:—

Les histoires qu'ils se sont racontées. The stories which they related to each other.

Les chevaux que mon ami s'est donnés. The horses which my friend has given to himself.

7. When used along with être in the formation of the compound tenses of naturally pronominal verbs, in which case the past participle always agrees with the subject:—

Ma sœur s'est repentie. My sister has repented.

Leurs chevaux se sont cabrés. Their horses have reared.

8. However, the naturally pronominal verb *s'arroger* is an exception; its reflexive pronoun being indirect object, and this verb admitting of a direct object, its past participle agrees with the latter according to the rules given above:—

Les droits que votre sœur s'est arrogés. The rights which your sister has arrogated to herself.

9. When forming part of a compound tense of a verb governing a succeeding infinitive, it is at the same time preceded by a direct object which is represented as performing the action denoted by the infinitive; in which condition it agrees with that direct object:—

Les dames que j'ai entendues chanter. The ladies whom I heard sing (singing).

10. When in a sentence containing the pronoun *en*, the participle is preceded by another object which is direct; or, when being joined to an adverb of quantity, the latter precedes the auxiliary; in which cases it agrees with that direct object:—

Je les en ai avertis. I have warned them of it.

Vous les en avez informés. You have informed them of it.

Plus il en a d'ennemis, plus il en a vaincus. The more enemies he has had, the more he has conquered.

* The past participle *prétendu* is the only exception; it is placed before its noun: *La prétendue princesse*, the self-styled princess.

actual performing of the operation. But the purposes of division may frequently be answered by these fractional expressions; for as they are of the same nature with other vulgar fractions, they may be added, subtracted, multiplied, or divided.

EXAMPLES.—(1.) Divide xy by a .

Here, $xy \div a = \frac{xy}{a}$.

(2.) Divide $(d-x)$ by $-h$.

Here, $(d-x) \div -h = \frac{d-x}{-h} = \frac{x-d}{h}$.

And here it may be observed that if the signs of all the terms of a fraction be changed both in the numerator and denominator, its value will not be altered; for $\frac{-bc}{-d} = +c = \frac{+bc}{+d}$, and $\frac{bc}{-d} = -c = \frac{-bc}{+d}$.

103. If some of the letters in the divisor are in each term of the dividend, the fractional expression may be rendered more simple, by rejecting equal factors from the numerator and denominator.

EXAMPLE.—Divide ab by ac . Ans. $\frac{b}{c}$.

These reductions are made upon the principle that a given divisor is contained in a given dividend, just as many times as double the divisor is contained in double the dividend; triple the divisor in triple the dividend, and so on.

104. If the divisor is in some of the terms of the dividend, but not in all, those which contain the divisor may be divided as in Art. 93, and the others set down in the form of a fraction.

EXAMPLE.—Divide $ab+d$ by a .

Here $(ab+d) \div a = \frac{ab+d}{a} = \frac{ab}{a} + \frac{d}{a} = b + \frac{d}{a}$. Ans.

105. The quotient of any quantity divided by itself or its equal, is evidently unity or 1. Thus $\frac{a}{a} = 1$, $\frac{x}{x} = 1$, $\frac{abc}{abc} = 1$, etc.

106. If the dividend is greater than the divisor, the quotient must be greater than a unit; but if the dividend is less than the divisor, the quotient must be less than a unit.

EXERCISE 7.

Perform the following exercises in division.

1. dhr by dy .

2. $ahm-3ay$ by ab .

3. $ab+bx$ by by .

4. $2am$ by $2xy$.

5. $dxy+rx-hd$ by x .

6. $2ah+ad+bx$ by a .

7. $bm+3y$ by $-b$.

8. $2my+dh$ by $2m$.

9. $3ax$ by $3ax$.

10. $6a$ by $4a+2a$.

11. $a+b-3h$ by $a-3h+b$.

12. $ax+x$ by x .

13. $3bd-3d$ by $3d$.

14. $4xy-4a+8ad$ by $4a$.

15. $3ab+3-6m$ by 3 .

16. $25a$ by $5a$.

17. $4x$ by $20x$.

KEY TO EXERCISES IN LESSONS IN ALGEBRA.

EXERCISE 6.

1. $15a^2xy$.

2. $\frac{1}{2}m$.

3. $\frac{1}{2}m+n$.

4. $\frac{1}{2}m$.

5. $\frac{1}{2}m$.

6. $\frac{1}{2}m$.

7. $\frac{1}{2}m-3ax^2y+3ax^2y$.

8. $\frac{1}{2}m-x^2-x^2-4x^2$.

9. $\frac{1}{2}m-2x^2y+a^2$.

10. $\frac{1}{2}m-4x^2-3x^2+6x^2$.

11. $\frac{1}{2}m+6ab-12a-18b^2+8$.

12. $\frac{1}{2}m+6ab-12a-18b^2+8$.

13. $\frac{1}{2}m+6ab-12a-18b^2+8$.

14. $\frac{1}{2}m+6ab-12a-18b^2+8$.

15. $\frac{1}{2}m+6ab-12a-18b^2+8$.

16. $\frac{1}{2}m+6ab-12a-18b^2+8$.

17. $\frac{1}{2}m+6ab-12a-18b^2+8$.

18. $\frac{1}{2}m+6ab-12a-18b^2+8$.

19. $\frac{1}{2}m+6ab-12a-18b^2+8$.

20. $\frac{1}{2}m+6ab-12a-18b^2+8$.

21. $\frac{1}{2}m+6ab-12a-18b^2+8$.

22. $\frac{1}{2}m+6ab-12a-18b^2+8$.

23. $\frac{1}{2}m+6ab-12a-18b^2+8$.

24. $\frac{1}{2}m+6ab-12a-18b^2+8$.

25. $\frac{1}{2}m+6ab-12a-18b^2+8$.

26. $\frac{1}{2}m+6ab-12a-18b^2+8$.

27. $\frac{1}{2}m+6ab-12a-18b^2+8$.

28. $\frac{1}{2}m+6ab-12a-18b^2+8$.

29. $\frac{1}{2}m+6ab-12a-18b^2+8$.

30. $\frac{1}{2}m+6ab-12a-18b^2+8$.

31. $\frac{1}{2}m+6ab-12a-18b^2+8$.

32. $\frac{1}{2}m+6ab-12a-18b^2+8$.

33. $\frac{1}{2}m+6$

11. When a past participle has for direct object the adverbial phrase *le peu*, it agrees with the following noun, when *le peu* means a small quantity :—

Le peu de fortune que j'ai acquise The little fortune I have acquired is enough for me.

12. The past participles *coûté* and *valu* only agree when taken in a figurative sense :—

Je ne regrette pas les peines que cet ouvrage m'a coûtées. I do not regret the trouble that work has cost me.
Les honneurs que sa conduite lui a valu. The honours his conduct procured him.

MISCELLANEOUS EXAMPLES.

Vous avez des livres bien reliés. You have well-bound books.
Vos filles sont estimées. Your daughters are esteemed.
Ces terres sont bien labourées. These lands are well ploughed.
Mes voisins sont tombés d'accord. My neighbours have come to an understanding.
Elles sont venues nous trouver. They came to us.
La victoire que nous avons remportée. The victory which we have gained.
Les champs que vous avez labourés. The fields which you have ploughed.
Vous vous êtes repentis de votre faute. You have repented of your fault.
Elle s'est souvenue de sa promesse. She remembered her promise.
Les soldats que j'ai vus passer. The soldiers whom I saw passing.
Les musiciennes que j'ai entendues jouer. The musical ladies whom I heard playing.
L'indiscrétion que nous nous sommes reprochées. The indiscretion with which we reproached one another.
Les événements qu'elles se sont racontés. The events which they related to one another.
Les fruits que j'en ai reçus. The fruits which I received from it.
Plus il a eu d'amis, plus il en a trompés. The more friends he has had, the more he has deceived.
Le peu de patience qu'il a montrée a suffi pour le faire réussir. The little patience he showed has sufficed to make him succeed.
Quels avantages vous a valu les peines qu'il vous a coûtées ? What advantages have you derived from the troubles he has given you ?

EXERCISE 193.

À l'ordinaire, as usual. Fleur, f. flower. Reproch-er (se), 1. ref. Avert-ir, 2. to warn. Malade, sick person. To reproach one's self. Boue, f. mud. Merveille (à), wonder. Rire, 4. ir. to laugh. Contance (de), usually, fully, perfectly. Sérieux, se, serious. Cueill-ir, 2. to gather. Parven-ir, 2. ir. to succeed. Suivant, according to. Décou-ir, 1. to decipher. Plus tôt, sooner, earlier. Tomb-er, 1. to fall. Décourag-er, 1. to discourage. Port-er (se), 1. to be, to do. Vol-er, 1. to steal.

1. Cette demoiselle ne se trouve-t-elle pas bien fatiguée ? 2. Elle est fatiguée et découragée. 3. Votre sœur est-elle allée à l'église suivant sa coutume ? 4. Ma mère et ma sœur y sont allées. 5. Votre sœur est-elle revenue plus tôt que de coutume ? 6. Elle est revenue plus tard qu'à l'ordinaire. 7. Cette pauvre malade est-elle tombée ? 8. Elle est tombée dans la boue. 9. Ma mère est-elle parvenue à déchiffrer ma lettre ? 10. Elle n'y est pas parvenue. 11. Quelles fleurs avez-vous cueillies ? 12. Les fleurs que j'ai trouvées sont plus belles que celles que vous m'avez envoyées. 13. Votre cousine ne s'est-elle pas bien portée ? 14. Elle s'est portée à merveille. 15. De quel livre vous êtes-vous servie, Mademoiselle ? 16. Je me suis servie du vôtre. 17. Nous nous sommes servies des nôtres. 18. Quelles fautes votre fils s'est-il reprochées ? 19. Les fautes qu'il s'est reprochées ne sont pas sérieuses. 20. Les avez-vous vus rire ? 21. Je les ai vus sourire. 22. Les avez-vous vus voler des fruits ? 23. Je les ai vus voler des pommes. 24. Les avez-vous avertis de leurs fautes ? 25. Je les en ai avertis. 26. Je ne les en ai pas avertis.

EXERCISE 194.

1. Are your books well bound ? 2. They are well bound, and well printed. 3. Did not your little girl find herself discouraged ? 4. She found herself tired, but not discouraged. 5. Have your sisters come to an understanding ? 6. They have not come to an understanding. 7. My brothers have come to an understanding. 8. Who came to you ? 9. Your friends came to us. 10. Is not your sister gone to church ? 11. My

sister is gone to church as usual. 12. Did your sister return sooner than usual ? 13. My sister returned later than usual. 14. Are the fields which you have ploughed large ? 15. The fields which I have bought are very large. 16. Where are the gentlemen whom you saw pass ? 17. The ladies whom I heard sing are in their room. 18. Did your poor sister fall ? 19. Did that poor sick woman fall in the mud ? 20. Did your sister succeed in reading that book ? 21. She succeeded in reading it. 22. Have you warned your sisters of their danger ? 23. I have warned them of it. 24. I have not warned them of it. 25. What pen has your mother used ? 26. She has used mine. 27. Have not those young ladies used my book ? 28. They have not used it. 29. Has your mother been well ? 30. She has been perfectly well. 31. Has she remembered her promise ? 32. She has remembered it. 33. Have you seen those boys laugh ? 34. I have seen them smile. 35. Have you seen them play ? 36. I have heard them play.

SECTION C. [§ 130, 131.] PRACTICAL SUMMARY OF THE RULES OF THE PAST PARTICIPLE.—II.

The participle past is INVARIABLE :—

1. In active verbs, when the direct regimen follows the participle :—

Mes nièces ont étudié leurs leçons. My nieces have studied their lessons.
Elles ont négligé leurs études. They have neglected their studies.

2. In neuter verbs conjugated with *avoir* :—

Mes cousines ont disparu. My cousins have disappeared.
Les cinq heures qu'elles ont dormi. The five hours which they have slept.

In the latter sentence, the word *pendant* is understood after *heures* :—

Les cinq heures pendant lesquelles elles ont dormi. The five hours during which they slept.

3. In impersonal verbs, whether conjugated with *être* or with *avoir* :—

Les chaleurs qu'il a fait cette année. The heat there has been this year.
Il est arrivé bien des malheurs. Many misfortunes have happened.

4. In reflective or pronominal verbs, of which the second pronoun is an indirect object, when no direct object precedes :—

Elle s'est proposée de partir. She proposed to herself to leave.
Elle s'est brûlé les doigts. She has burnt her fingers.

5. When the participle precedes an infinitive, and is preceded by a direct object, which is not the actor, but the object acted upon.* In this case the infinitive is generally rendered in English by the passive voice :—

Les chansons que j'ai entendu chanter. The songs which I heard (being) sung.

6. When the direct object preceding a participle is not the object of this participle, but of a verb following :—

La règle que je vous ai conseillé d'étudier. The rule which I advised you to study.

7. The past participle of *faire*, *fait*, followed by an infinitive, is always invariable :—

Je les ai fait raccommoder. I have had them mended.

8. After the pronoun *en*, when no direct object precedes; and, when joined to an adverb of quantity, the latter follows the auxiliary or the past participle :—

Vous a-t-on donné des fleurs ? Have they given you flowers ?
On m'en a donné. They have given me some.
Il n'avait plus de livres, mais il en a beaucoup achetés. He had no more books, but he has bought many.
Nous n'avions plus de chiens, mais nous en avons acheté plusieurs. We had no more dogs, but we have bought several.

* It follows from this rule, and No. 9, Section 99, that the agreement or non-agreement of the past participle, followed by an infinitive, considerably modifies the meaning of a sentence; e.g.: *Je les ai laissés punir*, with the participle agreeing with *les*, means, I allowed them to punish; whilst *je les ai laissé punir*, with the participle not agreeing with *les*, means I allowed them to be punished; that is literally, I allowed (somebody understood) to punish them. Students should bear this in mind when they translate French into English, or vice versa.

9. The past participles, *coûté* and *valu*, taken in their literal sense; the past participles *du*, ** voulu*, and *pu*, at the end of a sentence, when there is an infinitive understood, never agree :—

Les mille francs que ce cheval m'a coûté, il ne les a jamais valu. That horse was never worth the thousand francs it cost me.
Nous avons fait toutes les démarches que nous avons pu. We took all the steps we could (take).
Ils n'ont pas rempli les devoirs qu'ils auraient dû. They have not fulfilled the duties they ought (to have fulfilled).
Ils ont obtenu toutes les grâces qu'ils ont voulu. They have obtained all the favours they wished (to obtain).

10. A past participle preceded and followed by *que*, or *be-twee*, *que* and *qui*; a past participle having for object *le peu*, meaning *lack*, *absence*, never agrees :—

La lettre que vous avez exigé que j'écrive. The letter you required me to write.
Les marchandises que j'avais cru qu'il m'étaient expédiées, ne sont pas même commandées. The goods which I thought had been forwarded to me are not even ordered.
Le peu de patience qu'il a eu l'a empêché de réussir. His lack of patience prevented his being successful.

MISCELLANEOUS EXAMPLES.

Elles nous ont donné de bons conseils. They have given us good advice.
Elles nous en ont donné. They have given us some.
Les trois langues qu'il a couru. The three languages which he ran.
Les années que ces édifices ont duré. The years that those edifices have lasted.
La belle journée qu'il a fait hier ! What a beautiful day it was yesterday !
C'est la plus belle fête qu'il y ait eu. It is the finest feast that there has been.
Il s'est présenté deux de vos amis. There appeared two of your friends.
Ces demoiselles se sont nui. Those young ladies have injured one another.
Les Asiatiques se sont fait une espèce d'art de l'éducation de l'éléphant. The Asiatics have made the education of the elephant a kind of art.
Elle s'est imaginé qu'elle pourrait réussir. She conceived the idea that she might succeed.
Les fruits que j'ai vu voler. The fruits which I saw being stolen.
Les soldats blessés que j'ai vu porter. The wounded soldiers whom I saw (being) carried.
La chanson que j'ai entendu chanter. The song which I heard sung.
Les pommes que je vous ai défendu de manger. The apples which I forbade you to eat.
Je les ai fait partir. I obliged them to leave.
Elles m'ont apporté des oranges. They have brought me oranges.
Elles m'en ont apporté. They have brought me some.
Je regrette les quinze francs que ce cachet m'a coûté. I regret the fifteen francs this seal cost me.
Il ne les a jamais valu. It was never worth it.
Je lui ai rendu tous les services que j'ai pu. I have done him all the services I could.
Les marchandises que j'ai su que vous aviez reçues. The goods which I knew you had received.
Voilà la lettre que j'ai cru que vous étiez parvenue. Here is the letter which I thought had reached you.
Le peu de constance qu'il a montré l'a fait échouer. The lack of constancy he showed caused him to fail.

EXERCISE 195.

Auberge, f. inn. Enterr-er, 1. to bury. Pièce, f. piece.
Bien, m. good. Habill-er, 1. to dress. Racout-er, 1. to relate.
Dern-er, ère, last. Jeu-er, 1. to play. Reven-ir, 2. ir. to re-turn.
Disparait-er, 4. ir. to disappear. Lion d'or, m. Golden Lion. Soieries, silk goods.
Dorm-ir, 2. to sleep. Mort, e, dead.
1. Quelle auberge vous a-t-on recommandée ? 2. On m'a recommandé l'auberge du Lion d'or. 3. Quelles nouvelles avez-vous apportées ? 4. J'ai apporté des nouvelles agréables. 5. Vos voisines sont-elles habillées ? 6. Elles ne sont pas en-

* When there is no infinitive understood, the past participles *du* and ** voulu* agree with their direct object :—
J'ai eu reçu la somme qu'ils m'ont due si longtemps. I have at last received the sum they had been owing to me so long.
Je lui ai donné toutes les sommes qu'il a voulues. I have given him all the sums he wanted.

core habillées. 7. Ont-elles bien dormi la nuit dernière ? 8. Elles n'ont pas bien dormi. 9. Quand sont-elles arrivées ? 10. Elles sont arrivées à quatre heures et demie. 11. Ont-elles dormi plus de cinq heures ? 12. Les six heures qu'elles ont dormi leur ont fait beaucoup de bien. 13. Vos sœurs se sont-elles amusées ? 14. En jouant elles se sont fait mal au bras. 15. Se sont-elles raconté notre conversation ? 16. Elles se la sont racontée. 17. Vos amies ont-elles disparu ? 18. Elles n'ont pas disparu; elles sont revenues chez elles. 19. Les soldats que vous avez vu partir sont-ils revenus ? 20. Ils sont morts; je les ai vu enterrer. 21. Ne les avez-vous pas fait étudier ? 22. Je les ai fait lire. 23. Avez-vous apporté des soieries ? 24. Je n'en ai pas apporté. 25. Les soieries que j'en ai apportées sont superbes.

EXERCISE 196.

1. Have you not recommended my nieces ? 2. I have recommended them. 3. Have you brought me good oranges ? 4. I have brought you some. 5. Have you given any to my two daughters ? 6. I have given them some. 7. I would have given them some if I had had many. 8. Have you not neglected your studies ? 9. I have not neglected them; I never neglect them. 10. The years which that church has lasted, speak in favour (en faveur) of the architect. 11. The ten miles which he has run, have fatigued him. 12. Have your sisters injured each other ? 13. They have flattered themselves. 14. Did my friends present themselves ? 15. There came three of your sisters. 16. What did they imagine ? 17. She conceived the idea of reading Tasso (Le Tasse). 18. Have you seen them (m.) steal my apples ? 19. I saw them steal your peaches. 20. Have you heard them (f.) sing ? 21. I have heard them sing. 22. The songs which I heard sung are not new. 23. I found in your room the books which I had forbidden you to take. 24. The peaches which I have forbidden you to eat are not ripe (mûres). 25. Have you seen those soldiers ? 26. I saw them pass last week. 27. I saw them carried to the hospital (à l'hôpital) this morning. 28. Have you brought oranges from France ? 29. I brought some. 30. The oranges which I brought from it (en) are good. 31. Have you brought silk goods ? 32. I have brought some. 33. I have brought none.

SECTION CI.—THE PAST PARTICIPLE USED SUBSTANTIVELY.

1. Like present participles, French past participles are used substantively in reference to persons and inanimate objects. In the latter case they are of either gender, but most of them feminine; in the former they assume the gender indicated by their meaning :—

Les vaincus furent traités avec respect. The conquered were respectfully treated.
Sa prétendue est riche. His future wife is rich.
On vient d'apporter le mort. They have just brought the dead man.
Mes protégées sont là. The ladies I patronise are here.
Donnez-moi un reçu de cet argent. Give me a receipt for that money.
À la tombée de la nuit. At nightfall.
Ce sont de belles pensées. These are beautiful thoughts.
Ces faits sont bien connus. Those facts are well known.

MISCELLANEOUS EXAMPLES.

Ce parvenu est fort importun. This upstart is very troublesome.
Les deux mariées sont fort belles. The two brides are beautiful.
Après la bataille on porta secours aux blessés. After the battle they attended the wounded.
Les exilées supportaient leur sort avec fermeté. The exiled ladies bore their fate with firmness.
Le fini d'un tableau. The finish of a picture.
La crue de la rivière. The rise of the river.
Il a passé la nuit dans les tranchées. He spent the night in the trenches.
Il a deux coupes. He has two broughams.

EXERCISE 197.

Ar. été, arrested. Enterra, buried. On, they.
Ar.ivée, f. arrival. Etoussa, astonished. Parut (from paraître), appeared.
Bis. tôt, soon. Fort, adv. very. Tirot, m. driver.
Champ de bataille, m. Gardées, guarded. Présumé, adj. sham.
be. de. field. Intéressantes, interest-ing. Trouvrez, will find.
Condamné, m. convict. Couvert, covered.

1. Le champ de bataille était couvert de morts. 2. Le prétendu général fut bientôt arrêté. 3. L'arrivée du ministre nous étonna. 4. C'est un fait bien connu. 5. Les tranchées étaient bien gardées. 6. On enterra la morte immédiatement. 7. Le condamné parut. 8. Mes petites protégées sont fort intéressantes. 9. Vous trouverez leurs reçus dans votre tiroir.

EXERCISE 198.

Broken, cassé.	Fire, feu, m.	Still, encore.
Doctor, docteur, m.	In spite, malgré.	Turned out, mis à la
Do you know, connaissez-vous.	No (before a noun), pas de.	porte.
Enemy, ennemi, m.	Opened, ouvrirent.	Were lying, gisaient.
		Work, ouvrage, m.

1. They opened the trench in spite of the enemy's fire. 2. You will find beautiful thoughts in that work. 3. His brougham is broken. 4. These facts astonished us. 5. The sham doctor was soon turned out. 6. The dead and wounded were still lying on the battle-field. 7. Do you know that upstart? 8. Have you seen the bride? 9. The exiled ladies had no fortune.

KEY TO EXERCISES IN LESSONS IN FRENCH.

EXERCISE 127 (Vol. II, page 107).

1. Has that young man a sore throat? 2. Yes, Sir, he has had a sore throat for two days. 3. Have you often the headache? 4. I have the headache almost every day. 5. Have you not a sore arm? 6. I have a sore arm and a sore hand. 7. Has your sister the earache? 8. Yes, Madam, she has the earache and the toothache. 9. Is not your head cold? 10. No, Sir, but my fingers are cold. 11. Is not your face cold? 12. No, Sir, it is not cold. 13. Has that gentleman an aquiline nose? 14. He has an aquiline nose and a large mouth. 15. Has that young lady handsome teeth? 16. She has handsome teeth and handsome eyes. 17. Has that little boy small feet? 18. He has small feet and large hands. 19. Has not your niece blue eyes? 20. No, Sir, she has black eyes. 21. Have your scholars hurt their faces? 22. They have hurt their chest. 23. Have your daughters a good memory? 24. They have an excellent memory. 25. Those Italian ladies have not a fresh complexion.

EXERCISE 128 (Vol. II, page 107).

1. Qu'avez-vous à la main? 2. Il y a dix jours que j'ai mal à la main. 3. M. votre frère a-t-il mal aux doigts? 4. Il a mal aux doigts et à la main. 5. Qu'est-ce que M. votre frère a à la main? 6. Il a une plume à la main. 7. Votre petit garçon a-t-il mal à la gorge? 8. Il a mal à la gorge. 9. Votre sœur aînée n'a-t-elle pas mal aux dents? 10. Elle n'a pas mal aux dents, mais elle a mal au doigt. 11. Pourquoi le soldat ne marche-t-il pas? 12. Il ne peut marcher, il a mal au pied. 13. N'avez-vous pas mal aux pieds? 14. J'en ai pas mal aux pieds. 15. Si vous aviez mal aux doigts écrivez-vous? 16. Si j'avais mal aux doigts je n'écrirais pas. 17. Si votre frère avait mal à la tête, étudierait-il sa leçon? 18. Il n'étudierait pas sa leçon, s'il avait mal à la tête. 19. Ce monsieur n'a-t-il pas des douleurs à la poitrine? 20. Il a des douleurs à la poitrine et au côté. 21. Votre petite fille a-t-elle les yeux noirs ou bleus? 22. Elle a les yeux noirs et le teint frais. 23. Mlle votre fille n'a-t-elle pas mal aux dents? 24. Elle a mal aux dents et à l'oreille. 25. N'avez-vous pas froid aux mains et aux pieds? 26. J'ai froid aux mains, mais j'ai chaud aux pieds. 27. Ces dames n'ont-elles pas le nez aquilin? 28. Elles ont le nez aquilin, et le teint beau. 29. Mlle votre sœur a-t-elle les mains grandes? 30. Non, Monsieur, ma sœur a les mains petites. 31. Ces petites filles ne se sont-elles pas fait mal à la tête. 32. Elles ne se sont pas fait mal à la tête, elles se sont fait mal au visage. 33. Ce petit garçon a les cheveux noirs.

EXERCISE 129 (Vol. II, page 108).

1. Is not your niece going to be married? 2. She will be married next year. 3. Whom will she marry? 4. She will marry General M.'s eldest son. 5. Do you know who has married that couple? 6. The archbishop of Paris has married them. 7. Has he not also married Miss L.? 8. He has married her with Mr. G. 9. Whom has your young lady (daughter) married? 10. She has married Mr. L., captain in the 25th regiment of infantry. 11. Is not that old man wrong to marry? 12. He is not wrong to be married, but he is wrong to marry that young lady. 13. When are those princesses going to be married? 14. They will be married next month. 15. Who will marry them? 16. The bishop of Arras will marry them. 17. Whom are they to marry? 18. The elder is to marry Mr. W., and the younger Mr. G. 19. Has not captain G. married a relation of yours? 20. Yes, Sir, he has married a cousin of mine. 21. Who is that young lady? 22. She is a sister of mine. 23. Have you not a book of mine? 24. I have a book of yours and a pen of yours. 25. I have just spoken to one of your sisters.

EXERCISE 130 (Vol. II, page 108).

1. M. votre frère va-t-il épouser Mlle L.? 2. Oui, Monsieur, nous avons beau lui parler, il veut l'épouser. 3. M. votre père ne mariera-t-il pas votre sœur avec M. G.? 4. Non, Monsieur, il la mariera avec M. L. 5. Le capitaine H. est-il marié? 6. Non, Monsieur, il n'est pas encore marié, mais il se mariera l'année prochaine. 7. Qui a-t-il l'intention d'épouser? 8. Il a l'intention d'épouser une de mes cousines, qui est chez mon frère. 9. Qui les mariera? 10. Mon frère aîné a l'intention de les marier. 11. Votre plus jeune sœur est-elle mariée? 12. Non, Monsieur, elle n'est pas mariée. 13. Va-t-elle se marier? 14. Elle se mariera quand elle sera assez âgée. 15. Qui M. le colonel J. a-t-il épousé? 16. Il a épousé une de mes sœurs. 17. Combien de temps y a-t-il qu'ils sont mariés? 18. Il y a deux ans qu'ils sont mariés. 19. Cette demoiselle n'a-t-elle pas tort de se marier? 20. Elle a tort de se marier, elle est trop jeune. 21. Qui a marié M. le général S. et Mlle N.? 22. L'évêque d'Arras les a mariés. 23. L'archevêque d'York n'a-t-il pas marié ces époux? 24. L'archevêque de Paris les a mariés. 25. Votre tante ne se mariera-t-elle pas? 26. Elle ne se mariera pas. 27. Mlle votre sœur n'est-elle pas à la maison? 28. Non, Monsieur, elle est chez une de mes tantes. 29. M. votre frère est-il chez vous? 30. Non, Monsieur, il est avec un de mes parents. 31. Est-il marié? 32. Il n'est pas marié. 33. Le capitaine H. est-il marié? 34. Il s'est marié la semaine dernière. 35. Il a épousé Mlle H.

EXERCISE 131 (Vol. II, page 138).

1. Is your house large? 2. It is fifty feet long and twenty-five feet wide. 3. How long is your garden? 4. It is twenty-five mètres in length and twelve in breadth. 5. How large is this book? 6. It is eighteen inches long, thirteen wide, and three inches thick. 7. Is your house longer than this? 8. It is longer by two feet. 9. How deep is this well? 10. How high is that steeple? (What is the height of that steeple?) 11. It is three hundred and fifty-three feet high. 12. How tall is that officer? 13. He is tall. 14. How much taller than his brother is that Scotchman? 15. He is taller by the whole head. 16. Are you not much taller than I? 17. I am three inches taller than you. 18. How much is that stuff sold a metre? 19. It is sold three francs a metre. 20. Does not brown sugar sell dear? 21. It sells cheap. 22. How many letters do you write a week? 23. I only write six a week. 24. How much do you pay a week for your rent? 25. I pay only ten francs a week.

RECREATIVE NATURAL HISTORY.

TORTOISES AND TURTLES.

Few animals seem more sluggish than the common land tortoise. In truth, all its motions are, as Gilbert White says, "ridiculously slow," and its most active pace is but a hobble. But all this gravity of movement is not peculiar to all the members of this extensive order. The marsh, river, and sea species are very active in their motions, and make long journeys with the greatest ease, turtles having been found at sea more than 2,000 miles from land. Some of the huge land-tortoises of tropical isles do actually manage to travel at the rate of four miles a day. No trifling journey either for an animal with such crutch-like legs, and so heavy that six men are required to lift one from the ground. Let no one suppose that such limbs are a defect; all this slowness of movement is evidently a result of the remarkable structure which distinguishes these animals. The reader will see this in a few minutes; in the meantime let us pause to note how this absence of rapid movement is compensated. An animal requires the gift of speed in two cases only—either to escape from foes or to pursue its prey. But tortoises need not run from their enemies, most having an impregnable fortress in which they may bid defiance to nearly every animal. When the tortoise has shut itself up within the shell, even the hungry tiger can only grate his teeth in vain against the solid armour. The box-constrictor may, indeed, swallow the reptile, shell and all, but this is an extreme case. The most remarkable defensive armour is that of the box-tortoise (*pyxis*), the under-shell of which is furnished with a movable plate, and this being drawn up by powerful muscles, completely closes the opening through which the reptile's head and fore-feet have been withdrawn. The hind-feet and tail are protected by the overlapping shell behind. While danger remains, the besieged tortoise has only to remain quiet and patient, keeping its box firmly closed. The animal cannot be starved into a surrender, as it can fast for months without suffering much. When the foe retires, the shelly trap-door is let down,

upon which the head and feet are again thrust out, and the victorious tortoise has time to dine. Creatures furnished with such a defence have no need for rapid flight, and therefore the unnecessary power is withheld.

Most of our readers are probably aware that the upper part of the tortoise is called the *carapace* and the under the *plastron*. These singular structures demand a few notices. The ribs of this reptile are really outside the body, the carapace being composed of eight pairs of flat ribs, which thus form an expanded bony covering. The spaces between the ribs are filled up by tough shelly plates, forming so rigid a shield that some naturalist declared the wheel of a heavily-laden wagon might pass over the whole without breaking any of the plates. The reader will now see why the ribs are placed outside the body. The problem was, to form an invulnerable covering with the least inconvenience to the animal. Had the ribs remained within the body, and a heavy case been placed on the outside, the tortoise would have been terribly over-weighted. This has been avoided by making the ribs themselves serve for the protecting-shield, while they still perform their usual work in the animal's system. The plastron, or breastplate, is formed on the same general plan, consisting of nine bony plates, eight being arranged in pairs. The unprotected spaces, seen between the various parts of the shield in young and fresh-water tortoises, are gradually filled with bone as the animals grow. The "sutures," which join the ribs of the carapace, resemble very much, especially in young turtles, the lines of union between the eight bones of an infant's head. In a few turtles, and in the species called "soft tortoises," some parts of the shield consist only of plates of cartilage, which connect the bony portions together.

The tortoise is far too peaceable to be a military teacher, but the readers of Roman history will not fail to remember the famous formation of a column of infantry called "a tortoise," a name evidently suggested by the buckler of the animal. When a column of men advanced to the walls of a hostile town, the troops sheltered themselves from the showers of stones and darts by firmly interlacing their shields. An iron roof was thus raised over the heads of the assaulting column. The manoeuvre was not inaptly described as "the making of a tortoise."

The carapace and plastron are not the only peculiarities of structure which call for notice. The position of the shoulder-blade (*scapula*) is truly remarkable. The reader who will place his hand behind either of his shoulders will feel that the bone rests upon the ribs, but as these are outside the body of the tortoise it follows that the shoulder-blade must be inside the ribs. Thus an anatomist might describe the animal as "turned inside out," if he regard the position of the ribs; or "outside in," if he consider only the singular place of the shoulder-blade. These peculiarities of structure strongly influence the motions of the tortoise, but do not deviate from the unity of plan seen in vertebrate animals. The ribs and shoulder-blade are not absent, but wonderfully modified to suit the peculiar wants of the animal.

The stomach of the turtle seems as if specially fitted to convert coarse masses of sea-weed into that delicious fat so prized by the epicure. Vast, indeed, seems the distance between the reptile feeding on a mass of tangled weed at the bottom of the sea and the brilliant illumination of a great civic banquet hall. There the tureens of turtle-soup contain the results of the strange animal chemistry which has changed sea-weeds into that which delights every guest. The muscular coat of the stomach in the turtle is so admirably adapted to digest the coarsest vegetable fibre, that the Royal College of Surgeons have not deemed it beneath the dignity of science to preserve specimens of such a digestive apparatus in their museum. In truth, the bill, tongue, gullet, and stomach are all adapted for a digestive work of the highest order.

We should have supposed that reptiles which sometimes weigh above 1,000 pounds must not only have good digestion but also a most perfect circulating system, to convey the rich blood to every part. So far from this being the case, it is ascertained that some of the blood which has gone round the body, and is therefore vitiated, does not pass through the lungs to undergo the purifying process. It is actually sent round again in its deteriorated state, and the turtles do not die of consumption, but produce the richest food for human epicures. This is another puzzling peculiarity in the structure of these creatures.

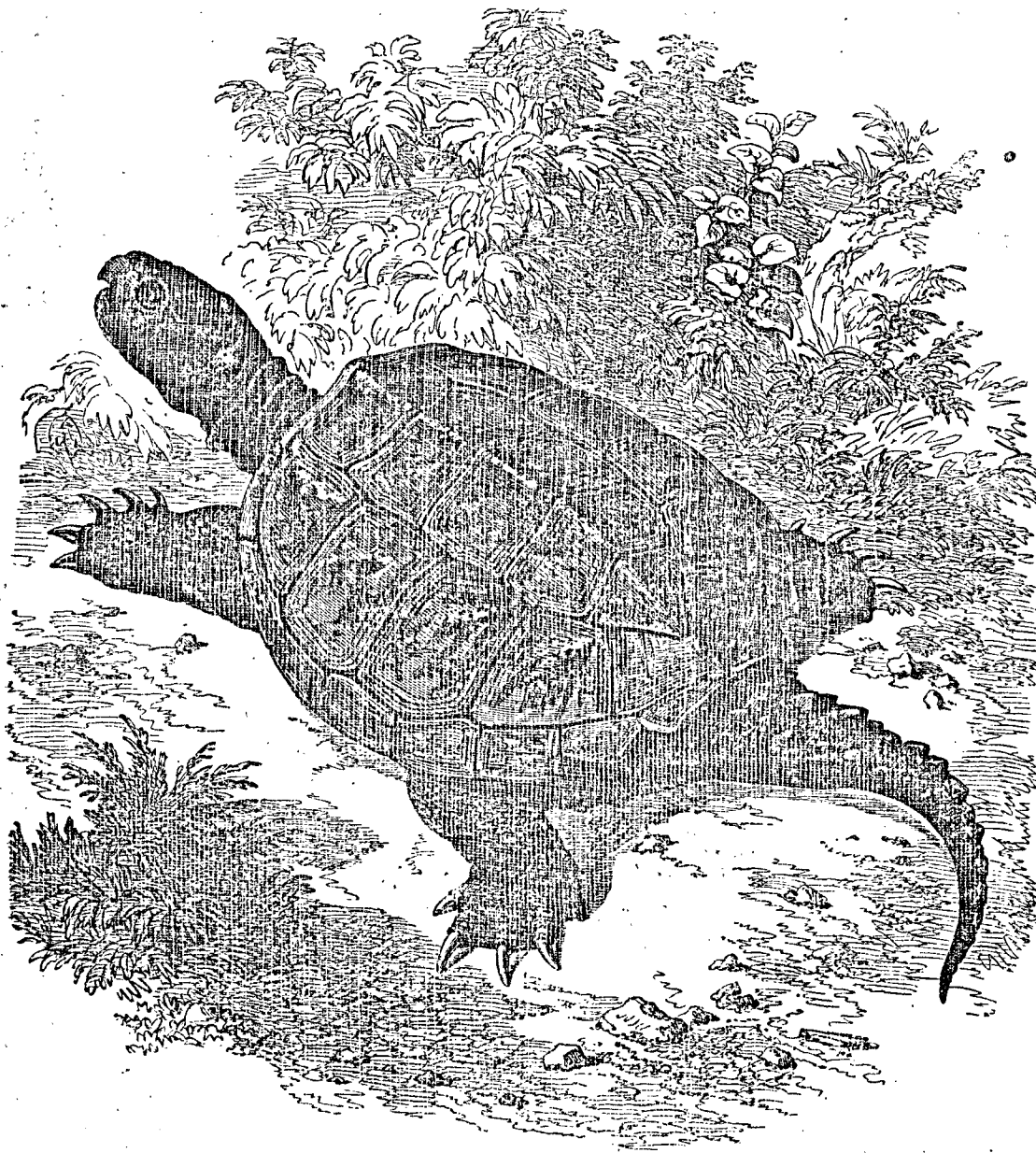
The brain and nervous system of the tortoise have received much attention from physiologists; the reason for this will soon be understood. When such men as the famous John Hunter, Cuvier, Professor Owen, and other great anatomists, make the brain and nerves of a tortoise their special study, we may be sure some deep problem awaits solution. Perhaps we shall best suggest the object sought in all these investigations by stating in a few words the experiments of the Italian naturalist, Redi. We have nothing here to do with the question whether such anatomical studies on living animals can be justified. Our space will not allow of the discussion of such a topic, and we must, therefore, simply take the facts as they are presented. The first experiment was performed on a common tortoise, the skull of which Redi opened, and removed the whole of the brain. Not satisfied with the mere extraction of the general mass, he actually scraped and washed out the cavity, so that no particle of nervous matter might remain. The Earl of Stafford would have called this part of the process "thorough." Some readers may suppose that the immediate death of the tortoise was the result. No such thing; the creature simply closed its eyes, and then gently moved about as if nothing very important had happened. Muscular power clearly remained, nor were there any signs of suffering. The vital energies were unaffected, for so rapidly did the healing process go on that the wound in the skull was covered with new skin in the short space of three days. The operation was performed in November, and the animal lived and moved about until the 15th of May. When this tortoise was examined after death, no signs of the formation of any new brain appeared. The experiment was repeated upon other tortoises, both land and fresh-water, and also on a turtle. The results were by no means uniform. Some of the brainless reptiles were able to move about with ease, others lost the power of locomotion; some lived for a considerable time after the operation, others died in about a week. Redi next went a step further by cutting off the head of a tortoise altogether, and noting the results. The animal managed to live without its head for twenty-three days, and retained the power of moving the limbs, but not of walking about. Two tortoises which had lost their heads in a similar manner, preserved so much vital energy that their hearts continued to beat and the blood to circulate for twelve days after decapitation! All these facts demonstrate that life is not destroyed in the tortoise by the mere loss of brain or head. We admit that these and other experiments have not brought us to a clearer insight into the mystery called life: the problem is still unsolved. We see plainly enough, however, that in these reptiles life is not altogether dependent on the brain, as vital action continues long after the brain has gone.

The eye of the tortoise might be described at great length, but want of space compels us to be very brief on this topic. The possession of three eyelids is common in birds, but we should not have expected to find such a defensive organisation in these slow-moving reptiles. Each eye has also two tear-glands, the object of the small one—called the Harderian gland—being to provide the third eyelid with the fluid necessary to give facility to its horizontal motion across the eye.

The tortoise family cannot rank very high among the animals useful to man. They supply food to a few tropical tribes, who use the huge carapaces of the larger species for vessels, and even for canoes. Some may remind us of the beautiful tortoise-shell furnished by one species of turtle; but pretty or even elegant combs and ornaments do not, after all, materially influence the happiness of man. These reptiles appear to possess a fair share of animal intelligence. Even the slow common tortoise learns to recognise those who pet it; but it is chiefly among the large tropical species that "cleverness" is found. Many of the volcanic islands near the equator swarm with giant tortoises, which are said to find out the remote mountain springs when the ingenuity of the natives is entirely at fault. We must admit, too, that the turtles show what may be called "judgment" in selecting and forming the nests for their eggs. These are not mere holes in the sand; the reptile constructs a covering over her eggs thin enough to allow the heat of the sun to enter, and yet sufficiently solid to protect the contents of the nest from the chilling damps of night. The mere position of the nests is a matter of importance, for if not placed above high-water mark, the first tide would sweep away the eggs. Let no reader smile incredulously if we venture to allow some degree

of "self-knowledge" to the turtles. The animals are certainly conscious of one weak point in their organisation—that if flung on the back the recovery of the right position is almost an impossibility unless the tide should reach them. When two turtles are engaged in battle, each endeavours to throw his foe on the back, as if quite aware of the helplessness of a rival

English Channel the seamen said that "Lord Nelson" was in a bad way and likely to die. The turtle was therefore thrown into its own element, in the hope that it might revive. Two years and more passed away, when the former owners of "Lord Nelson" were amazed to hear that he had been again caught at Ascension Island. It seemed almost beyond belief that the



THE TORTOISE.

when in that position. Probably, then, these animals are not so stupid as some may suppose. There are, indeed, naturalists who contend that the turtles, at least, are really clever, and are never tired of quoting the case of the one which found its way back to its native haunts through thousands of miles. As some readers may not have met with the incident, we will give the facts as reported. A ship carried away some turtles from Ascension Island, in the South Atlantic Ocean. One became the pet of the sailors, who named it Lord Nelson, and marked the carapace with a hot iron. As the ship was beating up the

turtle had found its way back through such an expanse of ocean. The marks made by the hot iron seemed, however, to place his "lordship's" identity beyond a doubt. Mr. Jesse evidently believes the turtle did really find its way back.

Many interesting topics connected with tortoises have been unavoidably passed over, and we are now compelled to conclude this paper. We may easily infer from the above brief remarks, that there is not an animal on the land or in the waters which does not disclose to an inquirer some fresh glimpse of endless diversity in structure, combined with beautiful unity in plan.

SKETCHING FROM NATURE.—III.

OBJECTS WITH RETIRING SIDES, ETC.

THE instructions we gave in the last lesson referred to the treatment of a subject when placed in a *parallel* position with ourselves, or with the picture plane; we then endeavoured to show that we must be guided by the rules of *parallel* perspec-

may form with the picture plane or with our position. Now, before we begin to make our drawing of the subject we are supposed to have before us, we must direct the attention of our pupils to a few remarks respecting the relation there exists between the object itself and the picture they are about to make of it. We undertake this, hoping it will give them a clear idea of what we mean by the expression "our position,"

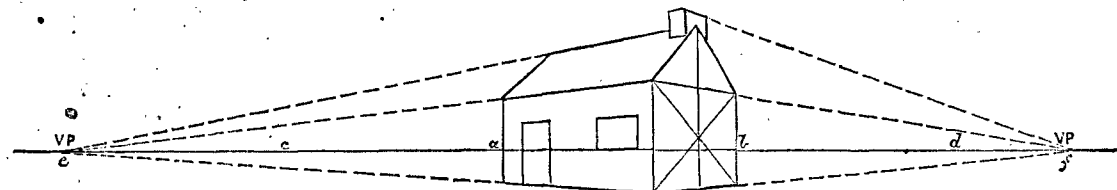


Fig. 4.

tive, when intending to draw an object in this position. It will be unnecessary to say more upon this subject, beyond recommending our pupils to turn back to "Lessons in Drawing," Vol. I., page 73, Figs. 27a, 28, to 31. The remarks we there made, in conjunction with all that we have recently explained,

as it is so essentially necessary to understand this term in connection with angular perspective. In considering this there is one condition which we doubt not will be admitted by all—that the outline of a subject, let it be composed of houses, trees, or anything else, ought to be so correct in the drawing



Fig. 5.—WEXHAM, SLOUGH.

will, we have no doubt, make the process sufficiently clear to the student.

Having given these directions, we will now suppose ourselves to be placed before a subject having an *angle presented to us*; in other words, *all its sides retiring*. In this case we must be guided solely by the rules of *angular* perspective. Here, once more we advise our pupils to refer to the instructions upon *Angular Perspective* in "Lessons in Drawing," No. V., Vol. I., page 136. After this there will be no difficulty in understanding that a building in *parallel* perspective can have but one position; whilst one in *angular* perspective may have many, according to the *angle of inclination* the side of the building

that if we held the paper up before us, between the objects and the eye (supposing the paper to be transparent), we should find that each line in the drawing would coincide with the corresponding line of the object. To do this exactly, or even to make an approximation to it, would indeed prove the ability of the draughtsman to be very great; and although to some of our pupils this view of the question may seem somewhat strange, yet a little consideration will quickly put aside all doubts that may arise as to the reasonableness of it; and if the meaning it conveys be rightly understood, we shall have got over half the difficulty in comprehending the meaning of the term "our position."

When we are drawing any subject from nature, we are supposed to be standing on an imaginary line which goes off directly on our right hand and on our left, and therefore neither advances nor retreats in its direction. Having thus placed ourselves, we must look directly before us; consequently, the way we are looking, which we will call the *direction of sight*, will form right angles with this imaginary line upon which we are supposed to stand. Now this imaginary line indicates our position, and if we were engaged in tracing a landscape from nature upon a piece of glass (which would be the picture plane), that glass or picture would necessarily be placed parallel to this imaginary line that marks our position: therefore whatever line in nature is found to be perpendicular to the picture plane would be perpendicular to the line of position also; and similarly, any line of the object which formed an angle with the one, would in like manner form an angle with the other. To most of our pupils this will no doubt be sufficiently clear, but as we wish to make it evident to all, if possible, we ask them to turn to Figs. 5 and 6, Lesson II. in Geometrical Perspective, Vol. II., page 225, which will illustrate our remarks. It will be seen how the picture plane is situated with regard to the eye, *E*. It is parallel with our position when we stand before it and look directly towards it, and when a line from the eye *E* to the surface of the picture plane is situated with regard to the picture plane, as the line *EP* with *HL*. Well, then, admitting this to be the case, we can understand that if a line in the object is so placed that each end is equidistant from the picture plane (that is, parallel with it), we have nothing more to do than draw it across the paper; it has no vanishing point; but when the line has one end nearer to the eye than the other, it then retires and is at an angle both with our position and the picture plane: all lines similar to this must have their vanishing points.

After the above remarks, we now come to the object of the present lesson, namely, to give some general directions to our pupils how they are to proceed when they are drawing retiring lines from nature.

The rule in Geometrical Perspective for finding a vanishing point is, "Draw a line from the station point parallel to the ground plan as far as the picture plane." When drawing from nature, our practice must be founded upon this regulation when we desire to determine the vanishing points for the retiring lines of buildings or other regular objects at whatever angle they may appear before us; all of which can very easily be done without the necessity of making a plan of the subject, even were that possible. We recommend the practice of a few very simple problems in Geometrical Perspective: for we can testify how much this branch of art prepares the mind of the student of nature to perceive facts which might otherwise be lost to him. It gives him confidence in placing his lines, and the proportions of the whole and parts of objects, so that when a doubt arises he has a means at hand to dispel it; therefore we urge those of our pupils whose only desire is to draw from nature without having any intention to pursue any branch of art in which geometrical drawing is indispensable, not to neglect the advantages a little geometrical knowledge affords, as we know from long experience how it imparts a readiness and certainty in drawing lines which in thousands of hands would run wild without its guidance. Upon the same principle we should, in Geometrical Perspective, "draw a line from the station point parallel with the ground plan:" so in like manner the student, when standing before his subject, should hold up his arm horizontally and parallel with the retiring side of the building he is about to draw, and if he then looks in the direction of his arm he will find he is pointing to the vanishing point, which probably may be marked by some conspicuous object in the distance, perhaps a particular tree or cottage, which he must fix as a vanishing point. He must then hold up his pencil at arm's length, and horizontally between his eye and the building, and measure its length on the pencil, then see how many of these lengths will be repeated between the end of the building and the object which had been previously marked as the vanishing point. We will suppose it is repeated twice: he must then commence by drawing the horizontal line, and then decide upon the size of the building, or the space he intends it to occupy in his drawing; say from *a* to *b* (Fig. 4). Repeat that space twice on the *HL*, first to *c* and then to *e*, which will be the vanishing point for all the parallel and horizontal retiring

lines upon that side of the building. The same practice must be observed for the retiring end of the building: the arm must be extended in a parallel direction to it, the point fixed upon, and the building measured on the pencil as before, and the distance repeated till it reaches the object the arm pointed at. (See Fig. 4, where it is repeated once and a half, first at *d* and the half at *f*, the object pointed at.) If we place ourselves further away from the building, its measured length would be repeated oftener to reach the *VP*. For an explanation of this see the remarks upon Fig. 39, "Lessons in Drawing," Vol. I., page 137. Another method, or substitute for holding out the arm to find the *VP*, is to place the pencil or a long ruler between the eye and upon or coinciding with the retiring lines. Those lines which are above the eye or *HL* will incline downwards, those below the eye will incline upwards, all meeting at the same vanishing point. (See "Lessons in Drawing," No. III, Vol. I., page 72, explanation of the *VP*.) Suppose we are about to draw the church (Fig. 5). As we are obliged to sit near to it, we are compelled to make the point of sight at *a* in order to bring the whole subject within the angle of vision, 60°, and consequently make it a case of angular perspective. If we could have sat further away from it, we might have made it a case of parallel perspective, and have fixed the point of sight at the *VP* of the end of the building. Under the present circumstances, if we hold out the arm parallel to the end of the building, we shall be pointing to the tree as the *VP*; this would be the vanishing point also for the parallel retiring lines of the porch. The ridge of the roof and all lines parallel with it would retire in the other direction, but being at a very small angle with the picture plane or with our position, they would meet the horizontal line at some distance out of the picture, so that it would be impossible to place the vanishing point within the paper; therefore we must hold up the pencil horizontally between the eye and the roof, like the line *b c*, by which we ascertain the proportion of the inclination.

It is a very difficult task to give a written explanation of all that is to be observed when drawing from nature. The broad, practical rules we have laid down we know to be simple in themselves, and we have endeavoured to make our explanations equally so, hoping very few of our pupils will fail to understand them, as we have written under a supposition that the problems in Geometrical Perspective in these pages have been studied, because through a knowledge of them many and great difficulties will be rendered easy and our explanations intelligible. If the eye only is to be depended upon, as some maintain, what need is there for any assistance at all, either from written instructions or from the lips of a master? As we have said before, there is not a line in nature but is subject to some especial rule for its representation; and unless the rule has been the guide for placing it, without fail that rule will become its judge to condemn it.

LESSONS IN GERMAN.—XII.

SECTION LXXXIII.—IDIOMATIC PHRASES (continued).

Beuten tragen (to bear or have hesitation) may be rendered "to hesitate, to doubt;" as:—Ich trage Beuten, es zu thun, I hesitate to do it. Er trug Beuten, es mir anzuvertrauen, he hesitated to entrust it to me.

1. Der compounded with verbs commonly expresses the idea of away, a loss, wrong, etc. (§ 97, 3. 4.); as:—Treiben, to drive; vertrieben, to drive away. Spielen, to play; verspielt, to lose at play. Leiten, to guide; verlesen, to misguide (to guide wrong); as:—Wie schnell verfliehet eine frohe, glückliche Stunde, how quickly a joyful, happy hour passes away. Ich habe mich verbrüht, I have heard wrong (misunderstood), etc. Certain uses, however, of this and many others of the same class (§ 95, etc.), are best illustrated by examples; thus, sehen signifies to see, and verstehen, to provide. Legen, to lay; and verlegen, to mislay; also, figuratively, to furnish, and hence to publish (a book), that is, to furnish the necessary means for producing the book, etc.

2. Ver frequently answers to our "on;" as:—Was geht hier vor? what is going on here?

VOCABULARY.

Neuerkennung, f. ut-	Anspruch, m. requis-	Billard, n. billiards.
terance, expres-	sion, claim, de-	Blasen, to blow,
sion.	mand.	sound.

Buchhändler, m. book-	Harfe, f. harp.	Spiele, m. player.
seller, stationer.	Horn, n. horn.	Stimmung, f. dispo-
Erwarten, to guess,	Instrument, n. instru-	sition, frame of
divine.	ment.	mind, humour.
Befehl, f. self-com-	Klavier, n. harpsi-	Unbekannt, unknown.
mand, counte-	chord, piano.	Verlag's-Buchhandlung, f.
nance.	Partie, f. game.	publishing-firm.
Flöte, f. flute.	Röthe, f. redness, red.	Verlegen. (See above,
Geige, f. violin.	Schach, n. chess.	R. 1.)
Gefühl, f. feeling, f. skill-	Schachmatt, check-	Wohin, wherefore,
fulness, clever-	mated.	for what reason.
ness.	Sohn, n. little son.	

RÉSUMÉ OF EXAMPLES.

Der Gesandte trug Beuten, allen	The ambassador hesitated to
Worten des Ministers zu trauen.	confide in all the words of
	the minister.
Dieser Buchhändler hat Goethe's	This bookseller has published
Sammtliche Werke verlegt.	the collected works of
	Goethe.
Ich habe meine Schlüssel verlegt.	I have mislaid my keys.
Der junge Mann konnte bei dieser	The young man may get into
Frage in Verlegenheit kommen.	difficulty by this question.
Dieser Herr will Regel mit ihm spie-	This gentleman wishes to play
len; allein er hat größere Lust,	ten-pins with him, but he has
eine Partie Billard zu machen.	(a) greater desire to take a
	game of billiards.
Mein Bruder spielt das Fortepiano.	My brother plays the piano,
bläst (spielt) die Flöte, und ver-	blows (plays) the flute, and
steht die Trommel zu schlagen	understands beating (striking)
(schlägt).	the drum.
Spielt Ihre Tante ein Instrument?	Does your sister play any in-
Sie spielt einmal auf der Gitarre,	strument?
jetzt aber spielt sie nicht mehr	She played upon the guitar
daran.	once, but now she plays upon
	it no more.
Dieser Herr bläst das Waldhorn sehr	This gentleman blows the
schön.	bugle horn very well.
Ich errichte den Augenblick, was ihn	I divined in an instant what
so außer Fassung gebracht hatte.	had brought him thus out of
	(his) self-possession.

EXERCISE 160.

1. Er trug Beuten, dem Fremden die goldene Uhr anzuvertrauen.
2. Der Vater trug Beuten, Alles zu glauben, was ihm sein Sohn erzählte.
3. Wer zu viel Beuten trägt, gewinnt wenig.
4. Sie hielten ihn für einen ordentlichen Menschen.
5. Ich hielt ihn für den Bürgermeister dieser Stadt.
6. Wie hielten ihn für etwas ganz Anderes.
7. Der junge Buchhändler hat ein neues Werk verlegt.
8. Ist die neue Grammatik des Herrn N. schon verlegt worden?
9. Sie ist so eben in der Verlagshandlung des Herrn N. erschienen.
10. Ich bin sehr in Verlegenheit, was ich in dieser Sache thun soll.
11. Die Mutter ist in Verlegenheit, weil sie den Namen der Straße vergessen hat.
12. Er ist in Verlegenheit, woher er die ihm fehlenden zwanzig Thaler nehmen soll.
13. Sie ist in Verlegenheit über das plötzliche Erscheinen eines Unbekannten.
14. Wollen wir eine Partie Schach oder Billard spielen?
15. Ich nehme lieber eine Partie Schach an, da bei diesem Spiele mehr der Verstand, als die Geschicklichkeit in Anspruch genommen wird.
16. Spielen Sie Schach gern (Sect. XLIII. 1)?
17. O, ja; nur habe ich zu wenig Gelegenheit, es zu spielen, wegen ich bei guten Spielern sehr oft schachmatt werde.
18. Spielen Sie ein Instrument?
19. Ja, ich spiele Klavier, und habe seit einigen Tagen angefangen, Geige zu spielen.
20. Spielen Sie Geige lieber, als Klavier?
21. Nein, ich spiele das eine Instrument so gern, wie das andere.
22. Blasen Sie die Flöte?
23. Nein, aber ich habe vor, das Horn blasen zu lernen.
24. Wie lange blasen Sie Flöte?
25. Seit ungefähr einem Monate.
26. Ich habe jene Papiere verlegt; ich weiß nicht, wo sie zu finden sind.
27. Die Schwester hat ihre Handschuhe und ihr Buch verlegt.
28. Den sonst so ruhigen Mann brachte ein solches Betragen ganz außer Fassung, und seine kurzen Antworten und die Röthe seiner Wangen ließen errathen, was in seinem Innern vorging.
29. Ich errichte augenblicklich die Ursache, die diese Stimmung in dem Gemüthe meines Freundes hervorgerufen hatte, und ließ es auch jenen errathen, damit er verlässiger in seinen Aeußerungen sein möchte.

EXERCISE 161.

1. He hesitated to entrust his attorney with the affair.
2. The mother hesitated to believe everything that her daughter told her.
3. I have mislaid your book, and am therefore in much trouble.
4. The child deceived its teacher, and he therefore hesitated to believe him again.
5. He played at billiards,

and lost all his money. 6. Will you play a game at chess with me? 7. No, I prefer a game at billiards, for I do not know much about chess. 8. Do you play any instrument? 9. Yes, I play the harpsichord, and I think of learning the violin. 10. Is your sister skillful at the piano? 11. No, but she is excellent at the harp. 12. At that question he lost all self-command, and knew not how to answer. 13. Mr. C. in London will publish the history of the kings of England shortly.

SECTION LXXXIV.—IDIOMATIC PHRASES (continued).

Recht (right) and links (left) are often used with zur; as:—Zur Rechten, zur Linken, for zu der rechten Hand, to the right hand; zu der Linken, to the left hand.

1. Gefallen, literally, to fall, or happen (acceptably), that is, to be pleasing, or agreeable; as:—Dieses Buch gefällt mir, this book pleases me. Gefallen lassen—to submit to, "to put up with;" as:—Ich lasse mir diese Behandlung nicht gefallen lassen, I cannot submit to this treatment—that is, cannot let this treatment please me.

VOCABULARY.

Auffstellen, to post,	Geigen, n. violin-	Rechts, adv. to the
draw up.	music.	right.
Beleidigung, f. offence,	Gitarre, f. guitar.	Stillschweigen, to be
injury.	Lied, n. song, air.	silent, to hold
Beschließen, to con-	Sint, adv. (See above.)	one's peace.
clude, resolve, de-	Sinns, adv. to the	Unterführung, f. exa-
termine.	left.	mination.
Feuertode, f. fire-	Mozart, Mozart.	Unterwerfen, to sub-
bell.	Natürlich, natural,	ject, submit.
Gefällig, suitable,	naturally.	Bewunderung, f. as-
proper.	Recht, adv. (See	tonishment, sur-
	above.)	prise.

RÉSUMÉ OF EXAMPLES.

Es ist Schade, daß bei vielen Men-	It is (a) pity that with many
schen die guten Anlagen und	men (the) good endowments
Talente nicht besser ausgebildet	and talents are not better
werden.	developed.
Es ist Schade, daß er nicht da war.	It is (a) pity that he was not
	there.
Das ist mir ganz recht.	That just suits me (is just as
	I'd have it). That serves me
	right.
Dem frommen Tobias war Alles	To the devout Tobias all was
recht, was Gott über ihn ver-	right that God ordained con-
hängte.	cerning him.
Ein Verleumdeter muß es sich ge-	A calumniator must submit to
fallen lassen, von seinen Neben-	be despised by his fellow-
menschen verachtet zu werden.	men.
In dem Stübchen dieser armen al-	In the little room of this poor
ten Frau saß zur Rechten die	old woman sat distress at
Noth, und zur Linken das Elend.	the right hand, and wretched-
	ness at the left.
Rechts sieht man die Schafe auf der	At the right are seen the sheep
Wiese weiden, und links die Ziegen	pasturing in the meadow, and
an dem Berge klettern.	at the left the goats clamber-
	ing upon the mountain.
Morgen über acht Tage reisen wir	A week from to-morrow we de-
von hier ab.	part (hence) from here.
Er begleitete seinen Gesang mit der	He accompanied his song with
Harfe.	the harp.
Die Begleitung dieses Stückes ist	The accompaniment of this
von dem berühmten Karl Maria	piece is by the celebrated
von Weber.	Charles Maria von Weber.
Unter solchen Umständen wurde das	Under such circumstances the
Verprechen natürlich gebrochen.	promise was of course broken.

EXERCISE 162.

1. Es ist Schade, daß Sie nicht eine Stunde früher gekommen sind.
2. Macht es, wie ihr wollt, mir ist Alles recht.
3. Mir ist Alles recht, was die Versammlung beschloßen hat.
4. Er mußte sich diese Beleidigung stillschweigend gefallen lassen.
5. Er mußte sich dieses gefallen lassen, was er sich unter andern Verhältnissen nicht hätte gefallen lassen.
6. Sie mußte es sich gefallen lassen, verleumdet werden zu sein.
7. Zur Rechten hatten wir das Gebirge, und zur Linken den Fluß.
8. Rechts und links waren feindliche Truppen aufgestellt.
9. Ihr werdet wieder zur Rechten, ney zur Linken von diesem Wege abweichen.
10. Wer ist Schuld (Sect. LIX. 2) an diesem Unglücke?
11. Unser Nachbar ist Schuld daran.
12. Der Schüler ist Schuld daran, daß er betrafft wird.
13. Mir steht gut

Schuld daran gewesen. 14. Morgen über acht Tage kommt ein Dampf-Schiff von New-York an. 15. Morgen über vierzehn Tage wird es ein Jahr, daß ich ihn gesehen habe. 16. Gestern vor acht Tagen ist sein Vater gestorben. 17. Das junge Mädchen begleitete ihren Oheim mit der Gitarre. 18. Der Freund begleitete mit dem Fortepiano das Orgelspiel des Italiensers. 19. Die Begleitung dieser Fieris ist von Mozart. 20. Dieses würde uns natürlich erscheinen, wenn wir es einer gehörigen Untersuchung unterwerfen wollten. 21. Wir fanden es sehr natürlich, daß er gestern nicht kam. 22. Ein natürliches Ereignis erregt keine Verwunderung. 23. Haben Sie heute Morgen die Feuerlöcher gehört? 24. Natürlich (Sect. LXXXII), denn ich war selbst bei dem Feuer. 25. Es ist natürlich, daß wir sterben müssen. 26. Ich begleite meine jungen Freunde nach Hause.

EXERCISE 163.

1. It is a pity that your friend did not arrive half an hour earlier. 2. I must submit to whatever my father resolves on. 3. John's new book pleases me much. 4. One must submit in this life to many things. 5. I would not submit to it, if I were in your place. 6. To the right hand we had the river, and to the left hand the mountainous forest. 7. Right and left we saw nothing but enemies' troops. 8. This day week we go to Berlin. 9. To-morrow fortnight my brother will arrive here. 10. A week ago yesterday a ship sailed for Australia. 11. Three days ago we had unexpectedly great pleasure. 12. It is a pity that the talents of this young artist are not better developed. 13. Your sister accompanied me with the harp, and sang to the piano of my friend. 14. It is quite natural that everybody must die. 15. The accompaniment of this piece is by Handel.

SECTION LXXXV.—DATIVE OF PRONOUNS, ETC.

The dative of the personal pronoun of the first and second person (seldom translatable) is often employed in familiar style, to intimate in a wholly indefinite manner a participation or interest on the part of the speaker or the person addressed; as:—Ich lebe mit den Knaben, I praise (for myself) the boy. Göthe mir nicht auf's Eis, do not go upon the ice. In der blutigen Schlacht bei Lützen ritt er Guch unter des Feindes Blüthen auf und nieder mit hülfem Blut (Schiller), in the bloody battle of Lützen he rode amid the lightnings of the firing, up and down in cool blood.

1. Davonlaufen = to run off; as:—Er ist bei Nacht und Nebel davon gelaufen, he has run away by night and fog.

Durchgehen has sometimes a like signification; as:—Der Diener ist mit dem Gelde durchgegangen, the servant has run away with the money.

VOCABULARY.

An'merken, to perceive.	Neugierig, inquisitive,	Störung, f. disturb-
Bewirkung, f. enter-	curious.	ance.
tainment, recep-	Rettung, f. deliver-	Um'sehen, to look
tion.	ance.	about.
Freundlich, friendly.	Etsen, sly, skittish.	Erreicfen, to grieve,
Geschehen, to become,	Comit, consequently,	vex, trouble.
booseem.	therefore.	

RÉSUMÉ OF EXAMPLES.

Das Tanzen macht mir kein Ver-	Dancing affords me no plea-
gnügen.	sure.
Ich merke es Ihnen an, daß Sie	I perceive (Sect. LI. Sieht man,
nicht zufrieden sind.	etc.) that you are not con-
	tented.
Das ist eine vertrießliche Sache.	That is a vexatious affair (or
	business).
Die Rede hat die Zuhörer vertrieß-	The speech (has) displeased the
ten.	auditors.
Er ist davon gelaufen.	He has run away.
Sehen Sie sich nach einer Wohnung	Are you looking about (you)
um?	for a residence (boarding
	place)?
Es geizt mir nicht, dem Greise zu	It does not become me to con-
weiterprechen.	tradict the aged man.
Ich habe ihn nie mit irgend einem	I have never offended him by a
Worte beleidigt.	single word.
Der Schmerz machte Alexander dem	Sudden passion caused Alexan-
Großen viel Verdruss.	der the Great much sorrow.
Ich lobe mir jenen Geyrenmann.	I praise that man of honour.

EXERCISE 164.

1. Vielen Menschen scheint es ein Vergnügen zu machen. Andere zu beleidigen. 2. Ich merkte es ihm an, daß er sich beleidigt fühlte. 3. Er

beleidigte nicht nur mich, sondern auch meinen Oheim. 4. Diese Sache hat mir sehr viel Verdruss gemacht. 5. Der ungerathene Sohn macht dem Vater viel Verdruss. 6. Es vertrieß den Lehrer, eigensinnige Schüler zu haben. 7. Diese Rede vertrieß manche Anwesenden. 8. Der vertrießene Knabe ließ seine Arbeit liegen. 9. Es vertrieß den Freund, daß ich ihm seine Briefe nicht beantwortete. 10. Ich verdanke ihm meine Rettung. 11. Somit verdanke ich ihm nächst Gott Alles. 12. Wenn es nicht bald anders wird, so laufe ich davon. 13. Bei solchen Ereignissen möchte man davon laufen. 14. Dem Knaben ist sein kleiner Hund davon gelaufen. 15. Dem Richter geizt es, nach der Urtheile tiefer Störung zu fragen. 16. Es geizt mir, über diese Sache zu schweigen. 17. Der Neugierige pflegt sich nach jeder Kleinigkeit umzusehen. 18. Ich ging in die Stadt, um mich ein wenig darin umzusehen. 19. Mein Freund will sich nach einer andern Wohnung umsehen. 20. Ich lobe mir die alten Zeiten. 21. Ich lobe mir die schöne Zimmer und die freundliche Bewirthung. 22. Die Pferde wurden schon, und gingen mit uns durch.

EXERCISE 165.

1. It does not become a child to contradict its parents. 2. I went to the town for the purpose of looking about. 3. I admire these beautiful apartments and their pleasant situation. 4. The thief ran away with the money before it was possible to overtake him. 5. He ran away for fear they should take him in the act. 6. It is a vexatious affair that he has lost my money. 7. I perceive that this little present pleases you. 8. I perceive that he has not spoken the truth. 9. Are you looking about for your father? 10. No, I am looking for my friends. 11. I praise these intelligent scholars. 12. Do not fall, little child. 13. My brother shoots a bird from a tree at eighty paces.

THE UNIVERSITIES.—II.

OXFORD.—II.

II. Advantages and Conditions of the University Curriculum.

i. The course open to students, described in the University statutes as *non ascripti*, more commonly known as non-collegiate students.

ii. Private halls.

iii. Collegiate education.

I. UNATTACHED STUDENTS.

Of the three conditions under which students can now matriculate in the University of Oxford, that of "unattached students" is at once the most recent in point of time, and the most popular as regards its requirements. By this it is not intended to be inferred that the majority of the undergraduates of Oxford are unattached students, but that the condition is the most independent, and the most likely to commend itself to those who seek a university course rather for its educational than for its social advantages. For this reason it is treated of first in the second chapter on the advantages offered by the University of Oxford. Its difference from the mode of passing through the University, which was without option till within the last few years, being only social, and the exercises and examinations required for degrees being the same for all the three classes of students, all the information that is common to all the three classes is given under this head; only that which is peculiar to the other classes being placed under the divisions respectively allotted to them.

The statute which provides for the admission to the University independently of any college or hall, was passed in the summer of the year 1868, the Rev. Francis Knyvett Leighton, D.D., Warden of All Souls College, being Vice-Chancellor at the time. The delegacy appointed under the statute for the special supervision of students of this class consists of the Vice-Chancellor, the Proctors, the Controller of Lodging Houses, a Censor, and six members of Convocation holding office for six years, of whom two are elected by Congregation, two by the Hebdomadal Council, and two are nominated by the Vice-Chancellor and Proctors subject to the approval of Convocation. The Censor is specially charged with the care and supervision of the conduct and studies of the non-collegiate students. Students of this class are, of course, like all other junior members of the University, also subject to Proctorial authority. Such students keep terms by residing in Oxford, either with their parents or in lodgings which have been duly licensed. Persons who desire to be admitted to the University as unattached students must apply to the delegates, who will supply them

with particulars of licensed lodging-houses, from which they can make a selection for their residence according to their means; and the delegates must be satisfied that the candidates are of good character, that they have the consent of their parents or guardians to live in lodgings, and that they are of sufficient attainments in the statutable studies of the University.

Twenty-five students were admitted in the first instance under these conditions; many more have since been matriculated, and the number on the books of the University averages about three hundred. In addition to these (all of whom are undergraduates), more than a hundred and thirty with the degree of B.A. or of M.A. are fully-privileged graduate members of the University. Such fruits of a system which is still in its youth can scarcely be considered otherwise than promising and encouraging.

The subjects of the examination for matriculation are as follow:—

1. Three books of Homer or one Greek play.
2. Three books either of Virgil's "*Aeneid*," or of the "*Odes*" of Horace.
3. Translation from English into Latin.
4. The elements of Greek and Latin Grammar.
5. Arithmetic, including Fractions, Decimals, and Proportion.
6. Euclid, books i. and ii.; or Algebra, as far as Simple Equations inclusive.

Each candidate must forward to the delegates (under cover to one of the censors, of whom any preliminary inquiries may be made with a view to matriculation) at least one week before the day appointed for the examination:—

1. A testimonial of good conduct and character.
2. A certificate that his parents or guardians consent to his residence in lodgings.

When a candidate has satisfied the delegates in the examination, he will be matriculated by the Vice-Chancellor as an unattached student of the University, and he can then begin at once to keep his terms.

The fees and dues to be paid by unattached students are, upon matriculation, £5, and subsequently of £4 10s. per annum for twelve terms. This last-named sum is paid (in consideration of the greatly reduced expenses of unattached students in other respects, and of the special privileges which are extended to them to compensate for the advantages which they are without, as not being members of any college or hall) in lieu of the ordinary "University dues" of £1 per annum paid by all other graduate and undergraduate, resident and non-resident members of the University. (After the twelfth term this payment is reduced to the normal £1 per annum.) These payments entitle them to the advice and supervision of the censors, and to all the University advantages which are the privilege of undergraduates.

The following fees are also charged:—

	£	s.	d.
Responsions	2	0	0
The First Public Examination	1	10	0
The Second Public Examination	1	0	0
The Final School	0	10	0

It has been found that the expenses of unattached students for board, lodging, and tuition, have in some few instances been brought as low as £15 per annum during residence; so that under these conditions, a student who is consistently economical may now obtain his degrees, including all expenses, for less than £150, whereas a degree was seldom obtained under the old collegiate system for less than an average of £1,000.

Twelve terms must be kept in residence by every student before he can take the degree of B.A.; and twenty-six—for none of which, after the B.A. degree, any residence is required—for the degree of M.A., which can be taken on the first day of the twenty-seventh term, or on any subsequent day on which degrees are conferred.

There are four terms in the academical year, viz:—Michaelmas, Lent (or Hilary), Easter, and Trinity (or Act) Terms. As regards the requirements of the University, Michaelmas and Hilary Terms are kept by a residence of six weeks in each; Easter and Trinity Terms, either by three weeks' residence in each, or by forty-eight days' residence in the two terms jointly. But as each college, so the delegates of the *non ascripti*, may

alter the conditions of residence from time to time, so that the conditions just mentioned be complied with.

Under the statute "*De Scholarium Residentia*," no student can reside in any lodgings which have not been duly licensed.

[It may be well to state in this place that this provision applies to collegiate and aularian students (some of the senior of whom are always in lodgings) as well as to the *non ascripti*.]

The following means of education are open to unattached students:—

1. All professorial or public lectures. [A list of these lectures is published at the commencement of each term, and posted on a notice-board in the schools' quadrangle, and in other places.]
2. The University Museum, with the lectures, etc., in Physical Science. [Information may be obtained at the Museum.]
3. The Bodleian Library and the Radcliffe Reading Room (the Camera) are open to all undergraduates. [Application, with recommendation from a M.A., to be made to the Librarian.]
4. The Taylorian Library of Foreign Literature, the Taylorian Galleries, and the Art School, are open to all undergraduates under due restrictions.

In addition to these advantages which are provided by the larger body of the University, the following colleges and halls—University, Balliol, Oriel, Queen's, Christ Church, St. Mary Hall, and St. Edmund Hall—have opened their lectures on certain conditions, at a varying but uniformly moderate cost, to such unattached students as may be recommended by the censors for such assistance.

Fees.

The fees payable by all members of the University before admission to degrees are as follow:—Degree of B.A., £7 10s.; degree of B. Mus., £5; degree of M.A., £12; degree of B.C.L. or B.M., £6 10s.; degree of B.D., £14; degree of D.C.L., D.M., or D.D., £40; degree of D. Mus., £10.

The sum of £1 per annum is also to be paid for University dues by all persons of the degree of M.A. or of any higher degrees who wish to remain on the Register of Convocation, and to retain membership of the University and the right of voting. This annual payment may be compounded for by a single payment determined by a scale drawn up according to the age of the compounder. Every one so desiring to retain the membership and privileges of the University, whether resident or non-resident, must also retain his name on the books of some college or hall, or of the delegates of the *non ascripti*, for which also a small annual payment is required, which varies slightly according to the customs of the several societies. These payments are mentioned in this place in order not to have occasion again to refer to fiscal matters.

Exercises and Examinations for Degrees.

Students in the University of Oxford are required to pass three distinct examinations, viz:—(1) *Responsions* before the Masters of the Schools (commonly known as the "Little-go"); (2) the *First Public Examination* before the Moderators (commonly known as "Moderations"); and (3) the *Second Public Examination* before the Public Examiners (commonly known as the "Great-go"). In this last examination there are five Schools, called the Schools of *Literæ Humaniores*, *Scientiæ Mathematicæ et Physicæ*, *Scientia Naturalis*, *Jurisprudentia et Historia Moderna*, and *S. Theologia*.

1. Responsions.

This examination is held three times in each year, printed notices being circulated of the times at which one of the Proctors will receive the names of candidates and the list of subjects in which they wish to be examined. Similar notice is given of all the University examinations. Each candidate for Responsions is required, in order to obtain his *Testamur*, to satisfy the Masters of the Schools, partly in writing, partly *vivâ voce*, in Latin and Greek Grammar; the translation of a passage from some English writer into Latin Prose; Arithmetic, as far as Square Root inclusive; and either the first two books of Euclid, or Algebra as far as Simple Equations inclusive. These subjects of examination never vary. In addition, each candidate must offer a portion of one Latin or one Greek author. A selection may be made from any of the several authors mentioned below, and a similar amount would be expected from any other authors.

In Greek.

Homer.—Any five consecutive books.

One of the Dramatists.—Any two plays. (Those offered are most usually selected from the "Hecuba," "Alceste," and "Medea" of Euripides; or from the "Ajax," "Philoctetes," and "Antigone" of Sophocles.)

Xenophon's *Anabasis*.—Any four consecutive books.

Herodotus.—Any two consecutive books in vol. i., or any three consecutive books in vol. ii.

Thucydides.—Any two consecutive books.

In Latin.

Virgil.—The "Georgics;" or any five consecutive books of the "Æneid;" or the "Bucolics" with any three consecutive books of the "Æneid."

Horace.—Any three books of the "Odes" (the "Epodes" counting as a Book of the "Odes"), and "De Arte Poetica;" or the "Satires," with "De Arte Poetica;" or the "Epistles," with "De Arte Poetica."

Juvenal.—The whole, except "Satires" ii., vi., and ix.

Cicero.—"Philippics," i. to iii.; or "De Senectute" and "De Amicitia;" or four of the Orations against Catiline, with Pro Archia.

2. First Public Examination.

This examination is held twice a year. Every candidate who passes it must have entered his name on the Proctor's list as previously to Responsions, producing at the same time his *Testamur* for Responsions, and must satisfy the Moderators in Latin and Greek Grammar; in either Logic or the elements of Geometry and Algebra; the four Gospels in Greek; and translation from English into Latin prose. These subjects never vary; and the examination, as in the case of Responsions, is partly in writing, partly *vivâ voce*. Such students as are not members of the Church of England may substitute for the four Gospels a Greek author equivalent in extent. In addition to the fixed subjects, each candidate must offer a portion of three Latin and Greek authors at least, of which one at least must be a portion of a historical or a philosophical work, and neither of which may be the same with either of the two offered for Responsions, excepting in other parts of the same authors. Candidates, unless offering themselves for the honour examination, must choose their three books from a list of poets and orators which is issued every year in Easter Term.

Among the authors offered to candidates from which to make their selection, are the following. Portions only of each author are usually required, both in the Pass and Class Schools, which are duly specified:—

Greek.	Latin.
Sophocles.	Virgil.
Demosthenes.	Horace.
Xenophon.	Juvenal.
Homer.	Cicero.
Plato.	Livy.
Herodotus.	Tacitus.
Thucydides.	
Aristotle.	

The following additional books are mostly offered by candidates for honours only:—

Greek.	Latin.
Æschylus.	Lucretius.
Aristophanes.	Terence.
Pindar.	Plautus.
Theocritus.	Catallus, with Propertius.

Candidates for honours may make up their lists from either or both of the above lists, but may not offer a larger number of historians than of orators.

Accurate critical and philological scholarship, Greek as well as Latin, Prose Composition and Versification, both in Latin and Greek, with a view not only to accuracy but elegance, are also required in candidates for honours. For the highest honours Logic is indispensable. Honours are also awarded in Mathematics as well as in Classics, the examination being confined to Pure Mathematics; but no honours, either classical or mathematical, can be awarded earlier in the University course than the fifth, or later than the eighth term from matriculation inclusive. A *Testamur*, similar to that given at Responsions, is awarded to all who satisfy the Moderators, the names of the

successful candidates for honours being divided into three classes (both in the Classical and Mathematical Schools), the names in each class being arranged alphabetically. The names of those who satisfy the Moderators in the Pass Schools are also printed in alphabetical order.

3. Second Public Examination.

This examination is held twice in every year, notice being given of the approach of the time in a similar manner to that adopted previously to the other examinations, and students enter their names before the Proctor as before, producing their *Testamur* for the First Public Examination. The examination, as before, is conducted partly in writing, partly *vivâ voce*. As a general rule, every candidate is required to satisfy the Examiners both in the Classical School, and also in some one of the four other schools above mentioned. There are some conditions under which some variations from this rule are permissible, but, as it is the latter part of the University course which is now under consideration, there is no occasion to dwell upon minor details, full particulars of which will be readily mastered as the student becomes familiarised to Oxford, and to its privileges and requirements. It will therefore be sufficient in this place to state general rules, passing by exceptions and occasional variations.

In the Classical School (*Literæ Humaniores*) every candidate to obtain the *Testamur*, except those who are candidates for honours in the Theological School, must satisfy the Examiners in Divinity, and in one Latin and one Greek author at most.

The term "Divinity" comprises the four Gospels and the Acts of the Apostles in Greek, the whole range of Bible History, the Thirty-nine Articles, and the Evidences of Religion. Of the two authors, one must be a philosopher, the other an historian, and neither may be the same with either of the two which the candidate brought in for Responsions, unless he now offers as many as four authors. Candidates, unless offering themselves for the honour examination, must choose their two books from a list of philosophers and historians which is issued every year in Easter Term.

Among the authors usually offered to candidates from which to make their selection, are the following. As before, only specified portions are required:—

Greek.	Latin.
Plato.	Cicero.
Aristotle.	Livy.
Herodotus.	Tacitus.
Thucydides.	

Candidates for honours only mostly offer Bacon's "Novum Organon," and Bishop Butler's "Sermons," or "Analogy," as additional books.

Candidates for honours may make up their lists from either or both of the above lists. Logic, also, is indispensable for either the first or second class in the honour list. The examination in Ancient History includes Chronology, Geography, and Antiquities; and Latin and Greek Composition is also within its range.

In the Mathematical School every candidate, to obtain the *Testamur*, must satisfy the examiners in the first six books of Euclid, or in the first part of Algebra. The examination for honours comprises the whole range of Mixed as well as Pure Mathematics; Mechanics, including Dynamics of Material Systems, Hydro-mechanics, Optics, and Astronomy, being usually offered by candidates for the highest honours.

In the School of Law and Modern History, the pass subjects consist of either English History to the end of the reign of Henry VIII., and that part of English Law which relates to Things Real; or English History from the accession of Henry VIII. to the death of William III., and that part of English Law which relates to Persons and Things Personal. These are the subjects most commonly in use (Lingard's "History of England" and Stephen's "Blackstone" being the usual text-books), but some variations are allowed. The honour examinations extend over a far wider range of subjects.

There are also Honour Schools of Jurisprudence and Theology, each embracing high subjects in its own branch of learning, particulars of which may readily be learned when the student has passed the earlier examinations.

In the School of Natural Science the pass subjects consist of Mechanical Philosophy, Chemistry, and Physiology. Every

candidate, to obtain the *Testamur*, must satisfy the examiners in two out of these three branches of Natural Science, as well as in some one of the particular sciences dependent on Mechanical Philosophy, which includes Mechanics, Hydrostatics, Pneumatics, Sound, Light, Heat, Electricity, and Magnetism. The course for honour-students is based on the above subjects, but requires a far more extensive knowledge than the pass-examination.

In each of these schools a *Testamur* is awarded to pass-men and glass-men alike; the names of the class-men being printed alphabetically in four classes; the names of those who only satisfy the examiners without taking honours being added in a separate division, also alphabetically arranged.

For the degree of M.A. no examination is required. For degrees in Divinity, Law, Medicine, and Music, special exercises must be performed, examinations passed, and requirements satisfied, particulars of which can be obtained from the Professors of the respective faculties, and from the Registrar of the University, the Rev. E. T. Turner, M.A., Fellow and Tutor of Brasenose College, whose official residence is at the Old Clarendon, in Broad Street, and whose courtesy in affording information is well known to all who have any acquaintance with Oxford.

II. PRIVATE HALLS.

There are two other ways of going through the University of Oxford than by entering it as an unattached student. The first of these is by matriculating at a private hall, of which there are now but two, known as Charsley's Hall and Turrell's Hall, so named according to the statute *De Aulis Privatâ*, after the licensed master who presides over them—namely, Mr. W. H. Charsley, M.A., and the Rev. H. J. Turrell.

Several other private halls have existed since the statute above referred to was passed, but all have been short-lived, and Mr. Charsley is the only master who has achieved any great success as the head of such an institution. An annual payment of £80 covers all expenses for fees, board, lodging, and tuition.

III. COLLEGIATE LIFE.

There are in the University twenty-one colleges and three halls, besides the private halls already mentioned, the chief difference between these respective sets of societies being that the colleges are corporate bodies, each endowed to support a body of Fellows; while the halls have no such endowment. In the colleges the tutors are mostly appointed by the Head out of the body of Fellows; in the halls the Principals are responsible for the tuition. With these differences in their constitution, the education, discipline, and duties of the students are the same in both colleges and halls; they lead a cœnobic life; dinner is served daily in the common hall; and divine service celebrated morning and evening in the chapel.

But for all students without exception—collegiate, aularian, and unattached—the duties, discipline, examinations, and other exercises for degrees, and responsibility to the University as a body, are identical. The usual chapel rule in the colleges and halls is to attend once each week-day (in the morning as a rule), and twice on Sunday. In some few colleges week-day attendance at chapel has been dispensed with for students who prefer to answer a "roll-call" at an early hour to show that they are not spending their time inactively.

The colleges are as follows:—

University.	Queen's.	Brasenose.	Jesus College.
Balliol.	New College.	Corpus Christi.	Wadham.
Merton.	Lincoln.	Christ Church.	Pembroke.
Exeter.	All Souls.	Trinity.	Worcester.
Oriel.	Magdalen.	St. John's.	Keble.
			Hertford.

• The three halls are—

St. Mary Hall.	St. Edmund Hall.
	New Inn Hall.

A large and very important addition to the collegiate system of the University was made in 1871 by the admission of Keble College (incorporated by Royal Charter on June 6th, 1870) to the privileges mentioned in the University Statutes, Tit. II., Sect. vi., on new Foundations for Academical Study and Education. The college was built as a memorial to the late Rev. John Keble, M.A., formerly Professor of Poetry in the University. It was "founded and constituted with the especial

object and intent of providing persons desirous of academical education, and willing to live economically, with a college wherein sober living and high culture of the mind may be combined with Christian training, based upon the principles of the Church of England." The college is governed by a Warden and Council, and the whole charge of the discipline and internal administration is by the charter vested in the Warden. This form of government is the chief point of difference between Keble College and the other collegiate societies of the University. The quadrangle is spacious, and the buildings extensive; and the chapel, for the erection of which no less than £25,000 was given by a single benefactor, is reputed to be one of the noblest places of worship in the University. A fixed charge of £27 per Term (counting Easter and Act Terms for this purpose as one) covers every expense, including the use of furnished rooms, board, University and College dues, tuition, and servants. A few necessary smaller items, which cannot be included in a fixed charge, are provided according to a fixed tariff, but are not allowed to exceed £3 per Term. All expenses within the college walls are thus brought within the limit of £90 per annum. The college has on its books the following members (the Archbishop of Canterbury being its visitor), the Warden, the Council of Twelve Members, six Tutors, the Bursar, four Exhibitioners, and a numerous list of Graduates and Commoners. It has also several Benefices in its patronage.

In most of the old colleges both scholarships and fellowships are now open to public competition, the latter being the more free of the two from local restrictions. In New College, Christ Church, and St. John's, a strong connection still subsists between these societies respectively and the schools of Winchester, Westminster, and Merchant Taylors, in a corresponding order. Exeter has still a connection with Devonshire and the Channel Islands; Queen's with the North of England; Brasenose with Hereford, Marlborough, and Manchester, and (by its rich Hulmeian foundation) with certain other parts of Lancashire; Jesus College with Wales; Pembroke with Abingdon School and the Channel Islands; and Worcester with certain parts of Worcestershire; but a large number of scholarships and exhibitions are now open to the most unrestricted competition. Few scholarships are now worth less than £80 per annum; many as much as and more than £100; and any economical student who can add £20 or £30 a year to the income of a scholarship, can go through the University in comfort and respectability. Scholars are usually expected to be candidates for honours; and any one who has the ability to procure election to a scholarship can only be prevented from offering himself for honours either by failing health or idleness. For the former cause, allowance will be readily made. The latter, or failure in the schools (*viâ*, plucking), may terminate the tenure of a scholarship. Several of the halls have scholarships or exhibitions as helps to economical men; but they are, for the most part, of less value than in the colleges. It must also be mentioned that of the halls, two—viz., St. Mary Hall and St. Edmund Hall—offer special advantages to students who are resolutely determined to live according to a strict rule of economy. At the same time every reasonable comfort, joined to the social advantages of the cœnobic life, is secured by membership of any one of these societies. But whatever temptations to extravagance the normal collegiate life may present, any one can, with entire comfort, bring his annual battle bills—including room-rent, tuition, kitchen and buttery expenses, i.e., all necessary food and drink (except wine and luxuries), coal, and washing—within £90; while in some of the halls stricter frugality has reduced this sum to £60. It is hoped that these few facts may serve to prove that Oxford has not yet come to the condition of being no longer a place for "the poor scholar." If the mind be firmly set upon the acquisition of knowledge, it can still obtain facilities at Oxford at a moderate cost.

LESSONS IN BOTANY.—XXXI.

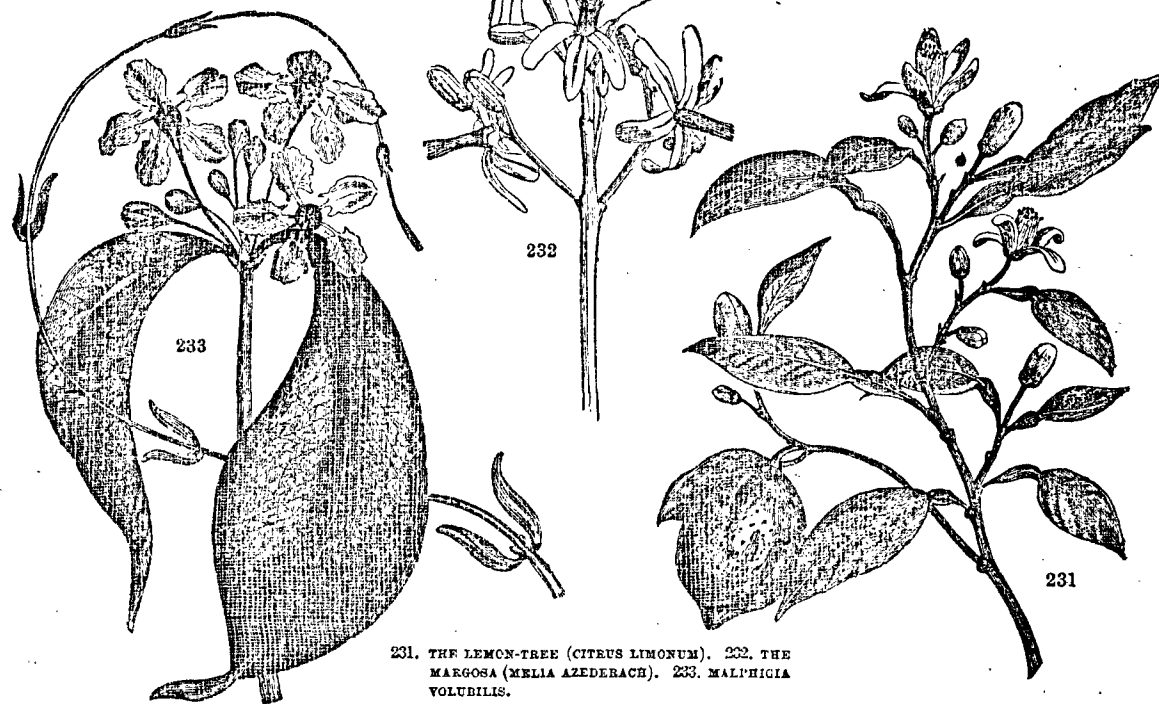
SECTION LXXV.—AURANTIACEÆ, OR CITRON-WORTS.

Characteristics: Calyx free, monocephalous; petals hypogynous, free, or almost free, in number equal to the parts of the calyx, with which they are alternate; imbricated in aestivation; stamens in number double or in multiples of the number of the petals.

distinct, monadelphous, or polyadelphous; filaments ordinarily flat and uni-seriate; style simple; stigma capitate; berry with thick rind and pulpy endocarp; seeds provided with a raphe, and frequently containing numerous embryos; embryo dicotyledonous, exalbuminous, straight; radicle superior.

The *Aurantiaceæ* are for the most part natives of tropical Asia, but they are now distributed over all parts of the globe where the temperature is sufficiently high to allow of their culture. Their leaves are alternate, without stipules, often with the blade jointed to the flattened petiole flowers, solitary or in corymbs. The bark, the leaves, calyx, petals, filaments, and epicarp, are all supplied with vesicles containing volatile oil.

This beautiful family is, chemically, remarkable for its volatile oil and aromatic bitter constituents, and its free acids (principally malic and citric). The citron (*Citrus*) is the principal genus of the family. The orange (*Citrus Aurantium*), originally a native of the East Indies, is now cultivated in almost all tropical and warm temperate countries. In France, however, it requires protection during the winter.



231. THE LEMON-TREE (*CITRUS LIMONUM*). 232. THE MARGOSA (*MELIA AZEDERACH*). 233. *MALPIGHIA VOLUBILIS*.

The citron (*Citrus medica*) is the most useful species of the genus; its berry, sometimes termed the bitter orange, is not edible, but from it are extracted many delicious perfumes, and its pulp makes an excellent confection. It is from the flowers of this species that chemists obtain the essence of neroli. All its various parts are in point of fact more aromatic than similar parts of the orange-tree. The lime (*Citrus Limetta*), and the lemon (*Citrus Limonum*), are members of the genus *Citrus*; all yield, from almost every part of their substance, an odorous volatile oil. The celebrated *Eau de Cologne* is nothing more than a solution of volatile oils extracted from many genera of *Aurantiaceæ* and dissolved in alcohol.

The citron was not introduced into Europe until subsequently to the period of Alexander the Great's Asiatic conquests. It is a native of Persia and Mesopotamia.

SECTION LXXVI.—MELIACEÆ, OR MELIADS.

Characteristics: Leaves usually alternate, simple, or pinnate, and without stipules; flowers generally symmetrical, arranged either in a panicle, corymb, cyme, or spike; the calyx and corolla having three, four, or five divisions; stamens monadelphous, and twice as many in number as the petals, with sessile anthers; disc hypogynous, and sometimes surrounding the

ovary in the form of a cup; ovary generally from two to five-celled, some plants of the genus having as many as ten or twelve cells; style single; ovules, one, two, or four in each cell attached to axile placentæ; fruit succulent or capsular, with loculicidal dehiscence; seeds few in number. The *Meliaceæ* are trees or shrubs, natives for the most part of the tropics. They contain acrid and bitter astringent principles, by virtue of which they are tonic and stimulating. The *Melia Azederach* (Fig. 232) is a tree growing in Persia and Syria, sometimes called the Margosa tree, but which has been naturalised in Mediterranean Europe and North America. It has febrifugal properties.

SECTION LXXVII.—MALPIGHIACEÆ, OR MALPIGHIADS.

Characteristics: Calyx free, five-partite, each division ordinarily furnished with two glands at the base; petals five, either inserted upon the receptacle or upon a hypogynous or sub-perigynous disc, clawed, imbricated in aestivation; stamens double in number. to the petals, sometimes all of them fertile, in

other cases partly sterile; filaments ordinarily coherent at their base; ovary composed of three carpels, rarely two, either incorporated with the axis or free at the summit, giving rise to three or two uni-ovulate cells; ovule reflexed, attached to a long funiculus, ascending by its free extremity; fruit composed of two or three carpels ordinarily samaroid; seeds inverted, dicotyledonous, exalbuminous, rarely straight, cotyledons ordinarily bent on themselves; radicle superior.

The *Malpighiaceæ* are usually trees or shrubs, for the most part covered with hairs, which sometimes degenerate into prickles, though not invariably. The leaves are ordinarily opposite, simple, devoid of stipules. Inflorescence, a cyme or corymb. This order takes its name from the Malpighia, or Barbadoes cherry, so called after Professor Malpighi of Pisa. This plant is nearly allied to the Galphimia, another of the same family, whose name, as the reader may see, is the word "Malpighia" transposed.

SECTION LXXVIII.—ACERACEÆ, OR MAPLES.

Characteristics: Calyx free, with four or five divisions, caducous; petals four or five, alternate with the sepals inserted upon a hypogynous disc, sometimes absent; aestivation imbricate; stamens four to twelve, ordinarily eight; ovary free, composed of two

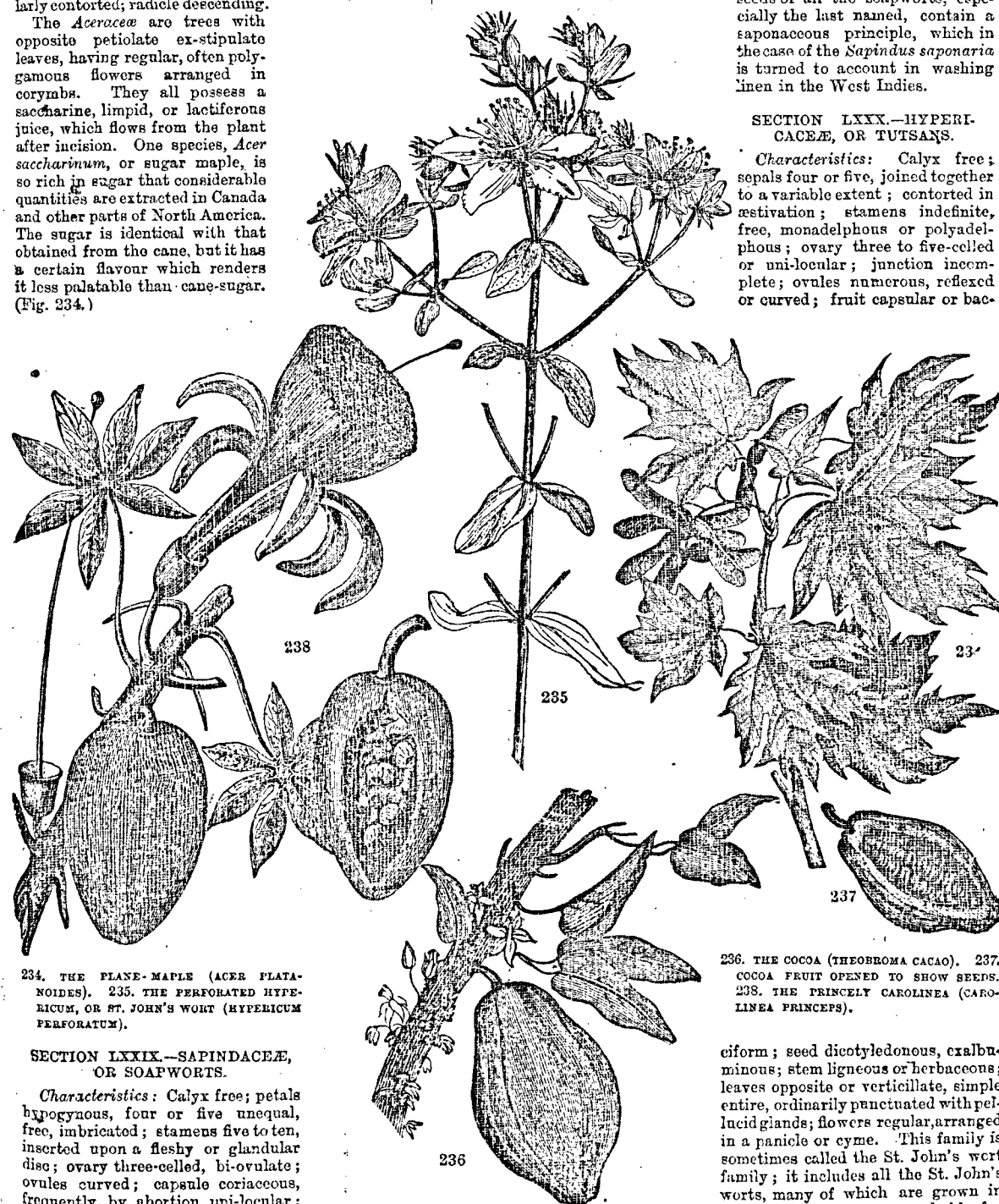
carpels, bilocular and perpendicularly compressed at the line of junction; ovules double in each cell, pendant or curved; fruit samaroid; seed dicotyledonous, exalbuminous, cotyledons irregularly contorted; radicle descending.

The *Aceraceæ* are trees with opposite petiolate ex-stipulate leaves, having regular, often polygamous flowers arranged in corymbs. They all possess a saccharine, limpid, or lactiferous juice, which flows from the plant after incision. One species, *Acer saccharinum*, or sugar maple, is so rich in sugar that considerable quantities are extracted in Canada and other parts of North America. The sugar is identical with that obtained from the cane, but it has a certain flavour which renders it less palatable than cane-sugar. (Fig. 234.)

the horse-chestnut, which is used in Switzerland for feeding sheep. The genus *Nephelium*, and the *Sapindus saponaria* or Indian soap-tree of the West Indies, belong to this family. The seeds of all the soapworts, especially the last named, contain a saponaceous principle, which in the case of the *Sapindus saponaria* is turned to account in washing linen in the West Indies.

SECTION LXXX.—HYPERICACEÆ, OR TUTSANS.

Characteristics: Calyx free; sepals four or five, joined together to a variable extent; contorted in aestivation; stamens indefinite, free, monadelphous or polyadelphous; ovary three to five-celled or uni-locular; junction incomplete; ovules numerous, reflexed or curved; fruit capsular or bac-



234. THE PLANE-MAPLE (*ACER PLATANOIDES*). 235. THE PERFORATED HYPERICUM, OR ST. JOHN'S WORT (*HYPERICUM PERFORATUM*).

SECTION LXXIX.—SAPINDACEÆ, OR SOAPWORTS.

Characteristics: Calyx free; petals hypogynous, four or five unequal, free, imbricated; stamens five to ten, inserted upon a fleshy or glandular disc; ovary three-celled, bi-ovulate; ovules curved; capsule coriaceous, frequently by abortion uni-locular; seed dicotyledonous, exalbuminous; stem ligneous; leaves opposite or alternate; flowers arranged in a terminal panicle.

One of the most noticeable of the large trees belonging to this family is the *Esculus Hippocastanum*, or common horse-chestnut. The bark of this tree contains a peculiar febrifugal principle called *æsculin*. In France starch is extracted from the seed of

their brilliant yellow blossoms. The *Hypericaceæ* are distributed over the hot and temperate regions of the globe, more especially of the northern hemisphere. All the ligneous species are intertropical.

Almost all contain, in addition to a volatile oil, resinous and balsamic juices which flow abundantly from the ligneous species,

236. THE COCOA (*THEOBROMA CACAO*). 237. COCOA FRUIT OPENED TO SHOW SEEDS. 238. THE PRINCELY CAROLINEA (*CAROLINEA PRINCIPIS*).

and which in the herbaceous ones may be found in the pellucid glands with which the leaves are studded. The tutsan (*Androsamum officinale*) is a native plant formerly employed in medicine, but now fallen into desuetude. The *Hypericum perforatum* (Fig. 235) is so called in consequence of the sieve-like appearance of its leaves, dependent on the number of transparent glandular points scattered over their surfaces.

SECTION LXXXI.—TERNSTREMIACEÆ OR CAMELLIACEÆ.

Characteristics: Leaves alternate, generally ex-stipulate; sepals and petals of flowers for the most part imbricated in aestivation; stamens hypogynous, many often combined with adnate or versatile anthers; ovary superior; styles filiform; seeds dicotyledonous, exalbuminous, few in number, or solitary, attached to axile placentæ.

The most important member of this family is the tea shrub (*Thea*). The virtues of tea depend on a combination of an astringent with a peculiar nitrogenised principle termed *theine*, also in part to a volatile oil.

Two centuries have not yet elapsed since tea was first introduced to Europe as an article of drink. Everybody is aware that two kinds of tea exist—black and green tea. Both are produced by the same plant, and the difference between the two results from peculiarities of manufacture. Several attempts have been made to naturalise the tea shrub in Europe, but invariably without success.

The beautiful camellia (*Camellia Japonica*), with its white and rose-coloured blossoms and dark, glossy green leaves, is a member of this family. It was originally brought from Japan, and takes its name from a Moravian Jesuit, Camellius.

SECTION LXXXII.—TILIACEÆ, OR LINDEN-BLOOMS.

Characteristics: Sepals five, caducous; valvate in aestivation; petals inserted upon a hypogynous disc, four or five or sometimes absent; imbricate in aestivation, often supplied at their base with a scaly appendage; stamens double in number or a multiple of that of the petals, all fertile, or the external ones sterile, free or polyadelphous at the base; ovary two to ten-celled; ovules reflexed; fruit capsular or indehiscent, coriaceous or fleshy; often only one-celled; seed dicotyledonous; embryo straight in the axis of a fleshy albumen; stem ligneous; leaves ordinarily alternate, stipulate; flowers regular, solitary, or in cymes or corymbs.

The *Tiliaceæ* for the most part are inhabitants of the tropical zone; they contain an abundant mucilage mingled with astringent and resinous matters. The flower of certain species contains a volatile oil; others possess a fleshy sapid fruit and edible stems. The seeds of most species are oily. The lindens are generally diffused, and in much estimation on account of the beauty of their foliage and the sweet aromatic odour of their flowers. The bark is fibrous, and sometimes turned to account in the manufacture of cordage. The wood, easily worked, is in repute amongst turners and sculptors. The flowers, much sought after by bees, contain an abundance of volatile oil, sugar, mucilage, gum, and tannic acid; their infusion is anti-spasmodic and diuretic. The oily seeds are occasionally employed as a substitute for cocoa. For an example of the leaves and blossoms of the common lime or linden-tree (*Tilia europæa*), see Lessons in Drawing, Vol. II., page 9.

SECTION LXXXIII.—BÜTTNERIACEÆ, OR BÜTTNERIADS.

Characteristics: Calyx four or five-partite; petals five, hypogynous or absent; aestivation valvate or contorted; stamens in some species equal in number to the petals and opposite to them, in other species double or multiple this number; filaments ordinarily joined in the form of a cupola, tube, or column, anthers two-celled; ovary four to ten-celled, uni-, bi-, or pluriovulate; ovules ordinarily ascending, reflexed; fruit generally a capsule; seed albuminous or exalbuminous; stem ordinarily woody, covered with radiating or bifurcated hairs; leaves alternate, simple, stipulate; flowers regular, arranged in panicles, spikes, or glomerules.

These plants contain an abundant mucilage, to which is generally added a bitter, astringent, extractive matter. The fruit of many species is saccharine; the seeds contain a fixed oil. The most celebrated plant of this natural order is the cocoa-tree (*Theobroma Cacao*, Fig. 236), a South American tree, the cultivation of which, however, has now extended to Africa and Asia.

In the midst of its bitter, pulpy fruit are found the seeds, which, when roasted, constitute the cocoa of commerce.

SECTION LXXXIV.—STERCULIACEÆ, OR STERCULIADS.

Characteristics: Calyx four or five-partite; petals hypogynous five, imbricated in aestivation, often absent; stamens indefinite, monadelphous; anthers two-celled, extrorse; stem ligneous, covered with radiating hairs; leaves alternate, simple, or digitate; flowers solitary, or in cymes or panicles.

Many species of *Sterculiaceæ* are cultivated in Europe. Pre-eminent amongst these is the baobab, which remains a small shrub in our greenhouses, but which, in its own country, grows to an enormous size. The *Pachira insignis*, a tree of Central America, has digitate leaves, elongated flowers of a bright-red colour, the petals of which are spread out at their summits. The *Pachira aquatica*, or *Carolinea princeps* (Fig. 237), is a plant which bears very large and elegant flowers, the petals of which are yellow on their upper surface, green below, the stamens have red filaments and yellow anthers. The *Bombax*, or silk cotton-tree, so called from the woolly hairs which surround the seed, as in the cotton-plant, is a member of this family.

LESSONS IN ENGLISH.—XXXII.

LATIN STEMS (continued).

LANGUAGE, in one point of view, is a silent record of human errors. If we believed language, we should have still to believe that the sun rises and sets; that upwards and downwards denote fixed relations, and that heaven is upwards alike at midnight and mid-day; that good humour and bad humour are the offspring of certain liquids (Latin, humor, moisture) in the material frame; that temper and distemper were the results of the due or undue mingling of these diverse liquids; that a jovial man was born under the planet Jupiter (genitive case, Jovis), the emblem of a jolly god; that a man of saturnine disposition owed his dull moroseness to his evil genius, Saturn; and that a mercurial fellow jumped about and frisked away because he had in him too much of the pagan god Mercury, the swift-footed messenger of Olympus. However, men suffer disasters (from the Latin, dis, *not, bad*; astrum, *a star*) without imputing the blame to their stars; though many are still under the vulgar delusion that our lot here depends on good luck and bad luck. Portents and prodigies in the skies and on the earth are words which show how men were once alarmed by any unusual phenomenon. Even so late as the reign of Charles II. Englishmen had faith in portents. During the plague, the vision of a flaming sword, reaching from Westminster to the Tower of London, seemed nightly to be present to the excited fancy of many of the residents in the metropolis, like the meteor-sword that hung over Jerusalem during the siege. The appearance of a comet some months before had caused superstitious feelings of alarm in the weak-minded, and by such persons it was regarded with scarcely less terror than that with which the Anglo-Saxons had beheld the comet which visited our hemisphere in the year 1066, on the eve of the Norman invasion.

However, these false fears and vulgar errors are rapidly disappearing. Lunacy is preserved amongst us in the close embrace of Westminster Hall, but we hence cease to believe that mental alienation is caused by the moon (Latin, luna, moon); and if we still in good Saxon speak of the moon-stricken, we do so as we speak of star-gazers, without ascribing any influence to the heavenly bodies.

One or two additional instances of the depravation of words may be given.

The term *officious* is used in a bad sense; an *officious* man is constantly interfering with what does not concern him. But in the root of the word there is nothing questionable or offensive. *Officium*, in Latin, signifies *duty*. According to its derivation, an *officious* man is simply a man who attends to his duty. But even so pure a virtue may be carried to excess. Excessive and perverted the attention does become if it is outward rather than inward, more apparent than real—if duty is a pretext or an excuse. A misunderstood sense of duty prompts even the sincere to meddle, and in meddling they become *officious*. I subjoin two instances: in the first, *officious* is used in a good sense; in the second, it is used in a bad sense:—

"Yet not to earth are those bright luminaries
Officious; but to thee, earth's habitant."—Milton.

"You are too officious

In her behalf that scorns your services."—Shakespeare.

Why should the word *resentment* signify the harbouring of a desire for revenge? Its component parts are very innocuous—namely, the Latin participle *re, again*; and the Latin verb *sentio, I feel*. *Resentment*, considered in its origin, is simply a return of feeling. Are, then, ill feelings more prevalent than good ones, that a return of feeling should be equivalent to retaliation? That retaliation should involve the bad feeling of revenge is not surprising, since its root is the Latin talio, which calls to mind the lex talionis, the law of repaying like for like—"eye for eye, tooth for tooth, hand for hand, foot for foot" (Exod. xxi. 24). The idea of revenge was moulded into the term long before it became a part of the English language. Yet, while *resentment* or a return of feeling is used in a bad sense, *recompense* or *repaying* is now used exclusively in a good sense. In Scripture, however, these words are used in a strictly judicial and juridical sense, thus: "Vengeance is mine; I will repay, saith the Lord" (Rom. xii. 19). "To me belongeth vengeance, and recompense" (Deut. xxxii. 35). Here, *vengeance* merely means the penal retribution which follows the infraction (or breaking) of the law. To attribute vengeance to God, in the sense of revenge or mere retaliation, is the height of moral absurdity.

The word *knave* meant once no more than *lad*, nor does its original (*knabe*), in German, now mean more. *Villain* was simply a peasant. A boor was a farmer; a varlet, a serving-man; a churl, a strong fellow. Time-server was used two hundred years ago quite as often in an honourable sense as in a dishonourable one. Conceits had once nothing concealed in them.

LATIN STEMS.

Latin Words.	Meanings.	Stems.	English Words.
Genitus	begotten	gen, genit	progeny, progenitor.
Genus (genêris)	kind	genus, genera	generation, degenerate.
Glacies	ice	glaci	glacial, glacier.
Gradus	a step	grad, gred, gradu, gress	graduate, retrograde, ingredient, aggression.
Retro	backwards	retro	retrogradation.
Gramen (graminis)	grass	gramini	graminivorous.
Gravis	heavy	gravi	gravity, gravitate.
Grex (gregis)	a flock	greg	gregarious, egregious.
Hæreo	I stick	her	adhere, coherent.
Hæsus	stuck	hes	cohesion, adhesion.
Hæres (hæredis)	an heir	hered, herit	hereditary, inherit.
Halo	I breathe	hal	exhale, inhale.
Haurio (haustus)	I draw	haust	exhaust.
Homo	a man	homi, hum	homicide, human.
Hortor	I advise	hort	exhort.
Hospes (hospitis)	a guest, a host	hospit, host	hospitable, hostess.
Hostis	an enemy	hosti	hostile.
Humus	the ground	hum	inhume, exhum.
Idem	the same	iden	identity.
Ignis	fire	igni, igne	ignition, igneous.
Infra	below	infern	infernal.
Insula	an island	insula	insulate, insular.
Peno	almost	pen	peninsula.
Intra, intus	within	inter, inti	internal, intimate.
Iter (itineris)	a journey	itiner	itinerate, itinerary.
Iterum	again	iter	iteration, reiterate.
Itum	to go	it	exit, circuit, transit, se-adjacent.
Jaceo	I lie	jac	conjugate.
Jactus	thrown	ject	inject, conjecture.
Jugum	a yoke	jug	conjugate.
Junctus	joined	junct	adjunct, conjunction.
Juro	I swear	jur	conjure, adjure.
Jus (juris)	right, law	juris, jurt	jurisdiction, juridical.
Jutus	assisted	jut	adjutant, coadjutor.
Juvenis	a youth	juveni	juvenile.
Lacer	to rend	lacer	lacerate.
Lædo	I strike	lidi	collide.
Læsus	struck	lis	collision.
Lapis (lapidis)	a stone	lapid	lapidary, dilapidate.
Latus	carried	lat	clate, translation.
Latus	wide	lat, lati	latitude, dilate.
Latus (latêris)	a side	later	lateral, equilateral.
Legatus	an ambassador	legat	legate, delegation.
Legatio	a gift	lega	legacy, legatee.

* Legatio is a Latin word of the Middle Ages.

Lego	I gather, read	leg, lect	collect, legible, lecture.
Lenis	gentle	leni, len	lenity, lenient, relent.
Levis	light	levi, lief, liev	levity, relief, relieve.
Levo	I lift up	lev	lecer, elevate.
Lex (legis)	a law	leg, legis	legal, legislator.
Liber (libri)	a book	libr	library.
Libellus	a little book	libel	libellous.
Liber	free	liber	liberty, liberal, libertine.
Licet	it is lawful	licit	illicit.
Lignum	wood	lign	ligneous, pyrolignous.
Ligo	I bind	lig, liga	ligament, oblige, religion.
Linguo	I leave	lingu	relinquish.
Lictus (relictus)	left	lict	relict.
Liqueo	I melt	lique, liqui	liquid, liquefaction.
Lis (litis)	strife, law-suit	liti	litigation, litigious.
Litera	a letter	liter	literal, literature.
Locus	a place	loc, loco	locality, locomotion.
Longus	long	long, longi	longitude, oblong.
Loqui	to speak	loqui, loquy, loqu, locu	colloquial, obloquy, loquacity, elocution.
Venter (ventris)	the belly	ventri	ventriloquist.
Ludo	I play	ludi, lud	delude, ludicrous.
Lusus	played	lus	delusion, illusion.
Lumen (luminis)	light	lumin	luminary, illumination.
Luna	the moon	lun	lunatic, sublunary.
Lux (lucis)	light	luc	lucid, pellucid.
Macies	leanness	maci	emaciate.
Macula	a spot	macul	immaculate.
Magnus	great	magni	magnify.
Male	wickedly	male, mal	malevolent, malversation.
Volo (volens)	I wish	volen	benevolent.
Verbo (versus)	I turn	vert, vers	convert, converse, versatile.
Mando	I entrust or bid	mand	mandate, command.
Maneo	I stay	man, main	permanent, remain.
Mansio	a staying	mans	manse, mansion.
Mano	I flow	man	emanate.
Manus	a hand	manu, mani	manual, manipulation.
Mare	the sea	mari	marine, maritime.
Mars (Martis)	Mars, the Ro- man god of war	mart	martial.
Mater (matri)	a mother	mater, matri	maternal, matricide.

The word *progenitors* has for its corresponding Saxon term *forefathers*; the term *ancestors* is used in nearly the same sense, only the latter simply points out those who have gone before us, our *predecessors*; the former includes the idea of descent: they of old were our progenitors, we are their offspring; they were our forefathers, we are their children or descendants.

The word *degenerate* denotes that which has lost the qualities of the kind (*genus, gēneris*) or race.

"The which thing declareth that men which have caste down their minds from the dignity of their nature, are so degenerat, and grown out of kinde, that thei seeme vterly to be brute beastes."—Calvine (Calvin), "Four Godly Sermons."

To graduate is to take a degree or step in learning in one of the universities. On entering a university a young man is said to *matriculate* (mater, a mother), because he becomes the child or pupil of the institution, which in regard to knowledge and discipline is his mother. After passing through a course of instruction, he, on proving fit and worthy by examination, takes a degree—that is, by receiving certain tokens, as the privilege of putting after his name B.A. or M.A., which is the same as calling himself, in the one case, *Bachelor of Arts*, or, in the other case, *Master of Arts*, he is declared and made known as having made proficiency in a greater or less degree in university learning.

"Invest me with a graduate's gown,

Midst shouts of all beholders,

My head with ample square-cap crown,

And deck with hood my shoulders."—Smart.

Egregious (from *e, out of*; and *grex, a flock or crowd*) denotes a person who is out of, that is, does not belong to, the multitude; one who is extraordinary and distinguished. *Egregious* is generally employed in a bad sense:—

"Thus have I adventured to expose the egregious folly, and to unmask the extreme corruption of heart, which assumes the buffoon or the philosopher indifferently, to laugh at misery and death, and make a mockery both of law and religion."—Warburton.

Religion is here given as from *ligo, I bind*. This seems the best etymology. Viewed in this light, *religion* is the source of obligation. Religion, placing man in immediate connection

with the Creator, deduces from that connection men's obligations: first, to God, from whom they are; and next, to each other, whom for God's will, and God's sake, they are to love and serve.

Delusion and illusion, though much alike both in derivation and import, yet differ somewhat. The common idea is that of *misleading*. By *delusions* others mislead and cheat us; by *illusions* we mislead and cheat ourselves. *Delusions* are substantial shows, presented in order to mislead; *illusions* are dreams and fancies which arise in an ill-regulated mind; the former are mostly dishonest, the latter are always weak; the former are *preconcerted*, the latter are *spontaneous*.

PARSING AND COMPOSITION.

For your exercise in parsing and composition take the ensuing letter of Mrs. Barbauld. Give an account of every part of it as well as you can. Convert it into simple sentences; and having studied it carefully, close the book and write down from memory all you recollect of it. Then correct your copy by the original. Having done so, write a letter to a friend, if possible, on similar topics.

"July 28, 1803.

"I am glad to find that you have spent the spring so pleasantly. But when you say you made the excursion instead of coming to London, you forget that you might have passed the latter end of a London winter in town after enjoying the natural spring in the country. We have been spending a week at Richmond, in the delightful shades of Ham walks and Twickenham meadows. I never saw so many flowering limes and weeping willows as in that neighbourhood. They say, you know, that Pope's famous willow was the first in the country; and it seems to corroborate it, that there are so many in the vicinity. Under the shade of the trees we read Southey's 'Amadis,' which I suppose you are also reading. As all Englishmen are now to turn knights-errant, and fight against the great giant and monster, Buonaparte, the publication seems very reasonable. Pray are you an alarmist? One hardly knows whether to be frightened or diverted on seeing people assembled at a dinner-table, appearing to enjoy extremely the fare and the company, and saying all the while, with a most smiling and placid countenance, that the French are to land in a fortnight, and that London is to be sacked and plundered for three days—and then they talk of going to watering-places. I am sure we do not believe in the danger we pretend to believe in; and I am sure that none of us can even form an idea how we should feel if we were forced to believe it. I wish I could lose, in the quiet walks of literature, all thoughts of the present state of the political horizon. My brother is going to publish 'Letters to a Young Lady on English Poetry.' He is indefatigable. 'I wish you were half as diligent,' say you. 'Amen!' say I. Love to Eliza and Laura, and thank the former for her note. I shall always be glad to hear from either of them. How delightful must be the soft beatings of a heart entering into the world for the first time, every surrounding object new, fresh, and fair—all smiling within and without! Long may every sweet illusion continue that promotes happiness, and ill befall the rough hand that would destroy them!"

THE HISTORY OF ART.

XV.—THE FRENCH SCHOOLS.

WITH the westward march of culture and civilisation, art at last began to fix its chief home in France. The early Bourbon kings had encouraged Flemish and Italian painters, and the native French artists soon learnt to follow in the steps of the foreign workers who came to them from beyond the borders. In France, art has always taken a more light and popular turn than elsewhere. Celtic fancy, and a certain meretricious love of passing subjects and small motives, has characterised most of the French schools. Devotional art is rarer there than in Italy and Flanders, domestic art than in England and Holland. Painting has rather gone in the general direction of the French temperament, towards light and gay subjects, or towards the glorification of the national heroes and the national arms. Instead of religion we get France; instead of home we get society and life. These are the key-notes of all French art, from the earliest to the latest times.

One of the first French painters to gain a European reputation was Nicolas Poussin, a Norman, born at the close of the sixteenth century. He studied at Rome, and came back to be appointed a court painter by Louis XIII. After a short time, however, he returned to Rome, where he spent the remainder of his life. Poussin had a great taste for a revived form of classical antiquity, and did much towards bringing about that love for a spurious classicism which marks the seventeenth and

eighteenth centuries. His subjects are chiefly mythological, and he delighted in such forms as nymphs, satyrs, fauns, and other sylvan deities. It is worth remarking, too, that in him the taste for landscape is clearly seen; he abandoned pure figure-painting, and made most of his backgrounds more or less distinctly rural. Many of his pieces are Bacchanalian, and strike thus early the characteristically French note. Poussin died in 1665.

Landscape painting reached its first full development in a far more famous contemporary of Poussin's. Claude of Lorraine (1600-1682) can only perhaps be reckoned as a Frenchman by courtesy, yet he stands in such intimate connexion with the French schools, that he can hardly be omitted from consideration here. Claude studied at Rome, where he passed the greater part of his life, and his landscapes are mostly very Italian in character. They are marked by a great limpidity, and an exquisite clearness, which seems almost unnatural to those who know nature only in her gloomier northern dress. The slow development of landscape from earlier forms of art is very well illustrated in Claude's work. He was almost the first painter, at least in the south, who ventured to depend upon scenery alone for his effects; and even he intersperses numerous figures in his landscape, apparently fearing to let it stand alone upon its own merits. In fact, this style of painting grew gradually out of figure pieces, by the constant dwarfing of the figures, and the fixing of attention upon the background. We can thus trace historically a slow change from the pure figure-painting of the mediæval Italians to the pure landscape of our own times. Our illustration of "The Mill"—a very characteristic Claude—with a foreground of figures and cattle, and a long aerial perspective of Italian scenery, admirably exemplifies the intermediate stage. Most of Claude's pictures, in fact, though really painted entirely for the sake of the background, are called by names implying figure-painting or historical treatment, such as the "Embarcation of St. Ursula," "The Queen of Sheba," and so forth. Landscape art was as yet afraid to trust itself wholly on its own merits, and preferred to represent itself as a variety of the older and more familiar style. Claude still remains in many respects unrivalled for his dreamy colouring and his mastery of perspective.

During the whole of the great Bourbon period, a succession of court painters lived at Paris, most of whom traced back their artistic pedigree directly to Poussin and his contemporaries. Philippe de Champagne (1602-1674), a Fleming settled in France, has left numerous fine works at the Sorbonne, the Luxembourg (now removed), and elsewhere. Charles Lebrun (1618-1690), also a pupil of Poussin, was another of these court-made painters, and he has handed down to us many memorials of the great reign of Louis XIV., of whose Academy he was the first president. During this period, when all life in France was hardening down into set conventional forms, with the monarchy for universal centre, art followed in the general stream, and gave itself up almost entirely to representing the victories of Louis, or the famous beauties of his court. There is no time when it had so little of freshness or spontaneity—when it fell so completely into a vicious circle of artificial traditions. Hence the works of this epoch, though often remarkable for technical excellence, have seldom attained any general reputation; and most of them are to be found in official buildings, or in the palaces of Versailles and the Louvre. Lesueur is one of the few painters of this school who are now remembered outside the purely artistic world; and even he is by no means to be placed in the first rank. The family of Coypel, four of whom were distinguished in their own day, are now almost neglected: their gaudy colouring and mere glitter were in the taste of the Versailles world, but are better fitted for monstrosities like Sévres pottery than for genuine art. In Antoine Watteau (1684-1721) this taste for a fanciful artificiality reached, perhaps, its culminating point. Watteau had been originally a theatrical scene-painter, and the habits he had acquired in this humble branch of art stuck to him through life. He painted very artificial rural scenes—*fêtes champêtres*, with rustic shepherdesses in a sort of travesty of court-dress; little theatrical ladies, in Louis XIV. costume, holding impossible crooks in their hands, and making love to courtly swains, while apparently tending a flock of remarkably polite and white-fleeced sheep. This sham rural sentiment and pretended simplicity was of a piece with the prevailing taste of the Bourbon court—

with the poetry of the minor versifiers, and the artificial prettiness of the fashionable beauties. J. B. Greuze (1725-1805) was one of the few more original painters of the later Bourbon period. His works are often of a domestic character, and in spite of a certain meretricious tendency, which has caused him to be much derided of late years, they are often really touching and tender in sentiment. The "Broken Pitcher," engraved many times, is a popular favourite in England, and exhibits Greuze at once at his best and worst. Taken as a whole, the times of Louis XV. and Louis XVI. in France coincided with a general decrease in artistic productivity; for art, like every other department of human work, declined with the universal decay of the French monarchy in its later stages.

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the false classical spirit of which he was almost the last, and certainly the chilliest, exponent. Almost all of the subjects are taken from the ancient mythology, but a few represent scenes in the life of Napoleon. His namesake, Jean Pierre David, generally known from his birthplace, for distinction's sake, as David d'Angers, was a sculptor of great power and real genius. Though almost equally classical in taste, his line of art fitted in better with the then prevailing style, and as time passed on he grew gradually more modern, with most of his contemporaries.

The rise and progress of the modern romantic French school lies almost beyond the scope of this series. After the fall of Napoleon wider modern views began deeply to influence the



THE MILL. (By Claude.)

With the great Revolution, an immense change set in, in art as in other things. Nevertheless, the artistic revolution came much more slowly than the social and literary revolutions. For awhile, France was almost too much engaged in war to find leisure for aesthetic pursuits; and when she settled down again, the influence of Napoleon was strongly exerted in favour of a certain hard, cold, academic classicism. Indeed, the revolution had brought classical ideas and even classical costumes into favour, and the school of David (1748-1825) was strongly marked by the prevailing tendency. His works have, for the most part, a great elegance of form and much power of technical expression; but they are frigid in the extreme, wholly lacking in life and spirit, and as dead as marble. David carefully endeavoured to restore what he conceived to be Greek ideas in painting; and as Greek art is now mainly known to us from its statuary, his results were such as are suitable to the sculptor's craft, but quite unfitted for pictorial representation. Tame and lifeless as they are, however, David's heroic pieces have a singular elegance of composition, and he has probably suffered somewhat at the present day in the universal reaction against

minds of Frenchmen, and a more natural realistic style, yet tinged with idealism of the romantic sort, became usual in art as in literature. In the record of this change, the great name of Eugène Delacroix (1799-1863), the most fiery and imaginative of modern painters, stands in the very first rank. He was, in fact, the leader of the romanticist revolution in art, as Victor Hugo was in literature. Paul Delaroche, his great contemporary and rival (1797-1856), stood half-way between the two schools, with a decided tendency towards romanticism. The wonderful battle-pieces of the Vernets must also be mentioned, instinct as they are with vivid life and realism. It is impossible to find room for more than the names of Ary Scheffer, Corot, Millet, Gérôme, and others. Indeed, within the present century, France has rapidly risen to be the real home of art, and it now leads the entire artistic movement of the world. At the present day, its living painters are the greatest masters of technique who have ever lived, and its art, though marred by many faults of sentiment and much underlying sensuousness of feeling, is still the widest, finest, and most varied in type that the world has ever possessed.

READINGS IN FRENCH.—VII. UN BIENFAIT N'EST JAMAIS PERDU.

SECTION II.

FANNY arracha l'épine, non sans peine, lava le sang qui coulait de la blessure;¹ puis, prenant son mouchoir, elle en fit (a) un bandage avec lequel elle enveloppa la patte du patient,² qui, se sentant soulagé, léchait le cou et les mains de sa petite bienfaitrice,³ en faisant entendre un gromement de plaisir; puis il se coucha (b) à ses pieds⁴ jusqu'au moment où les enfants se disposèrent à regagner l'habitation. Quand ils se remirent (c) en route, il alla se placer à côté de Fanny,⁵ en fixant sur elle des yeux expressifs et qui semblaient l'interroger. Elle lui fit signe de la suivre.⁶ Alors, oubliant sa blessure, faisant (d) un bond de plaisir, l'animal forma cortège (e) à la petite troupe,⁷ qui ne tarda pas à rentrer dans la cour de l'habitation.

À peine avaient-ils franchi la barrière, que le chien prit (f) sa course et se précipita vers un groupe⁸ rassemblé autour d'une sorte de marchand ambulant (g) qui, ayant ouvert plusieurs ballots, étalait ses marchandises devant les personnes qui se trouvaient là,⁹ en les invitant à faire quelques acquisitions. Le marchand poussa un cri de joie:

"Enfin te voilà (h) retrouvé, mon brave Moustache,"¹⁰ s'écria-t-il en flattant (i) le chien.

Alors il se mit (j) à raconter, qu'en traversant la forêt, son chien s'était égaré à la poursuite d'un animal sauvage,¹¹ qu'il ne s'était aperçu que long-temps après de sa disparition, qu'alors il l'avait vainement appelé; Moustache n'était pas revenu. Il avait alors supposé, qu'entraîné par son ardeur, son chien s'était égaré,¹² ou bien encore, qu'ayant attaqué quelque bête féroce, il avait succombé dans la lutte.

"Je ne m'étais pas tout à fait¹³ trompé," (k) ajouta-t-il, "car je vois que Moustache a été blessé. Mais qui donc a en la bonté de le secourir, de panser sa blessure?"¹⁴ s'écria-t-il en apercevant le mouchoir qui enveloppait la patte de Moustache.

À ces mots, le chien, comme s'il eut compris (l) ce que venait de dire son maître, se mit à courir au-devant des trois enfants¹⁵ qui se dirigeaient de ce côté, et se plaçant près de Fanny,¹⁶ il ne la quitta pas d'un instant, qu'elle ne fût arrivée à l'endroit où se trouvait le marchand.¹⁷

COLLOQUIAL EXERCISE.

1. Que fit Fanny après avoir arraché l'épine?
2. Que fit-elle de son mouchoir?
3. Comment le chien reconnaît-il sa reconnaissance?
4. Où se coucha-t-il ensuite?
5. Que fit le chien de Terre-Neuve, quand ils se remirent en route?
6. Quel signe lui fit alors Fanny?
7. Que fit le chien sur le chemin de l'habitation?
8. Où courut-il après avoir franchi la barrière?
9. Que faisait le marchand ambulant?
10. Que dit son maître en voyant le chien?
11. Que raconta le marchand?
12. Qu'avait-il supposé?
13. Qu'ajouta-t-il ensuite?
14. Que demanda-t-il en apercevant le mouchoir?
15. Comment le chien sembla-t-il répondre à la question de son maître?
16. Où se plaça-t-il?
17. Quand quitta-t-il Fanny?

NOTES.

- (a) From faire.
- (b) Se coucha, laid down.
- (c) From remettre.
- (d) From faire.
- (e) Forma cortège, escorted.
- (f) From prendre.
- (g) Marchand ambulant, itinerant.
- (h) Te voilà, here you are. [pedlar.]
- (i) Flattant, caressing.
- (j) Il se mit, he commenced.
- (k) Trompé, mistaken.
- (l) From comprendre.

SECTION III.

Alors, remuant la queue et regardant tour à tour Fanny et son maître, Moustache sembla la désigner comme celle qui lui avait donné ses soins.¹ Le marchand apprit (a) alors des enfants ce qui s'était passé;² le pauvre homme ne savait (b) comment leur témoigner sa reconnaissance,³ car dans ses longues courses, Moustache était non-seulement pour lui un compagnon de route,⁴ c'était un véritable ami, un brave défenseur qui l'avait préservé de mille dangers. Il voulait mettre à la disposition des enfants toute sa petite cargaison;⁵ mais M. Dérambert s'opposa à ce qu'il fit aucun sacrifice onéreux;⁶ seulement, comme il vit (c) que ce refus l'affligeait, il permit à ses enfants d'accepter quelques jouets de peu de valeur.⁷ Le lendemain, le marchand partit en demandant à M. Dérambert la permission de revenir dans quelque temps visiter son habitation,⁸ ce qui lui fut accordé de grand cœur.

Trois mois à peine s'étaient écoulés (d) depuis cette époque, lorsqu'un jour Alfred, s'étant mis (e) à la poursuite d'un papillon, s'écarta sans qu'on fit attention à sa disparition.⁹ Sur les dix heures du matin, heure à laquelle les trois enfants avaient l'habitude d'aller à la vallée déjeuner à l'ombre du châtaignier, on fut très-surpris de ne le point voir avec Auguste et Fanny.¹⁰ On l'appela, on le chercha de tous côtés;¹¹ bientôt tout le monde fut sur pied. Alfred ne parut (f) pas. Le père et la mère, tous les domestiques parcoururent en vain les alentours;¹² ils n'en découvrirent aucune trace;¹³ désespérés de cet événement, ils se partagèrent en plusieurs bandes;¹⁴ ils allèrent avec leurs voisins, qu'ils avertirent du malheur qui leur était arrivé, à la découverte, et ils s'enfoncèrent dans la forêt qu'ils battirent (g) en tout sens avec la plus scrupuleuse attention.¹⁵ Mille fois ils appelèrent l'enfant par son nom, ils n'en reçurent aucune réponse.¹⁶ Cependant, les derniers lueurs du jour n'éclairaient plus que faiblement les recherches,¹⁷ et l'on n'était venu calmer les inquiétudes de M. et de Mme. Dérambert: les approches de la nuit redoublèrent leurs alarmes.¹⁸ Dans leur désespoir, ils ne voulurent jamais consentir à retourner dans leur domicile.¹⁹ Ils allumèrent des torches de résine et firent (h) retentir les bois, les vallées, du nom chéri d'Alfred.²⁰

"Alfred, mon Alfred! où es-tu?" s'écriait la mère de l'accent de voix le plus déchirant; mais c'était en vain. Je n'osais (i) pas non plus de vous peindre le désespoir d'Auguste et de Fanny²¹ pleurant, sanglotant. Le châtaignier, le ruisseau, les frais bocages qu'ils parcouraient ensemble ne présentaient aucune trace d'Alfred.

COLLOQUIAL EXERCISE.

1. Que fit le chien en regardant Fanny?
2. Qu'apprit le marchand, des enfants?
3. Le pauvre homme paraissait-il ému?
4. Pourquoi était-il si reconnaissant?
5. Que voulait-il donner aux enfants?
6. À quoi M. Dérambert s'opposait-il?
7. Que permit-il à ses enfants d'accepter?
8. Que demanda à M. Dérambert le marchand, à son départ?
9. Qu'arriva-t-il trois mois après?
10. À quelle heure s'aperçut-on de l'absence du petit Alfred?
11. Que fit-on alors?
12. Où allèrent le père, la mère et tous les domestiques?
13. Trouvèrent-ils le petit garçon?
14. Comment firent-ils ensuite?
15. Examinèrent-ils bien la forêt?
16. Leur recherche eut-elle quelque succès?
17. Quelle heure était-il alors?
18. Quel fut l'effet des approches de la nuit, sur les parents de l'enfant?
19. Voulurent-ils rentrer chez eux?
20. Que firent-ils ensuite?
21. Auguste et Fanny partageaient-ils le chagrin de leurs parents?

NOTES.

- (a) From apprendre.
- (b) From savoir.
- (c) From voir.
- (d) S'étaient écoulés, had elapsed.
- (e) From mettre.
- (f) From paraître.
- (g) From battre.
- (h) Firent, caused; from faire.
- (i) From essayer.

KEY TO EXERCISES IN LESSONS IN FRENCH.

EXERCISE 132 (Vol. II., page 138).

1. Quelle grandeur a le jardin de M. votre père?
2. Il a vingt-cinq yards de longueur et dix de largeur.
3. La maison de votre cousin est-elle grande?
4. Elle a cinquante-six pieds de longueur et quarante de largeur.
5. Votre maison est-elle plus grande que la mienne?
6. Elle est plus grande que la vôtre de dix pieds.
7. Savez-vous quelle profondeur a ce puits?
8. Il a vingt-cinq pieds de profondeur, et, six de largeur.
9. Combien ce drap se vend-il le mètre?
10. Il se vend seize francs le mètre.
11. Combien recevez-vous par semaine pour votre travail?
12. Je reçois cinquante francs par semaine pour mon travail.
13. Combien votre ami paye-t-il par mois pour sa pension?
14. Il paye soixante-dix francs par mois.
15. Êtes-vous plus grand que votre cousin?
16. Je suis plus grand que lui de toute la tête.
17. Votre neveu n'est-il pas plus grand que votre fils?
18. Il est plus grand que mon fils, de trois pouces.
19. De quelle grandeur est cette chambre?
20. Elle a soixante pieds de long (longueur) sur quarante de large (largeur).
21. De quelle taille est M. votre frère?
22. Il est de haute taille (grand), il est plus grand que moi.
23. Combien de livres lisez-vous par semaine?
24. Je lis dix volumes par semaine.
25. Combien le beurre se vend-il la livre?
26. Le beurre se vend deux francs la livre.
27. Savez-vous combien votre fils gagne par jour?
28. Il gagne autant que le vôtre; il gagne dix francs par jour.
29. Combien cette soie vaut-elle le mètre?
30. Elle vaut six francs le mètre.
31. Notre ami est de taille moyenne.
32. Allez-vous à l'église deux fois par jour?
33. Je vais à l'église une fois par jour.
34. Votre fils va-t-il à la poste tous les jours?
35. Il y va six fois par jour.

EXERCISE 133 (Vol. II., page 139).

1. Have you forbidden that man to set his foot inside your house?
2. I have forbidden him.
3. Have you sheltered those things from the rain?
4. I have sheltered them from the rain and wind.
5. Have you acquainted your brother with that affair?
6. I have not acquainted him with it.
7. Have you not enabled him to study?
8. I have enabled him to instruct himself if he wishes to do it.
9. Will you put that aside?
10. I am going to put it in the sun.
11. Would not your friend come in?
12. He would not alight.
13. Has not your dyer put on his apron wrong side out?
14. No, Sir, he has put it on right side out.
15. Have you not put that giddy person out of doors?
16. We have shut the door in his face.
17. At what hour do you sit down to table?
18. As soon as the cloth is laid.
19. Does that man dress well?
20. He always dresses after the English or the Italian fashion.
21. Did not those children commence weeping?
22. Instead of beginning to weep they began to laugh.
23. Why do you not commence writing?
24. It is time to sit down to table.
25. Are those Sicilian ladies well dressed?
26. They are exceedingly well dressed.

EXERCISE 134 (Vol. II., page 139).

1. Le monsieur a-t-il mis pied à terre ce matin?
2. Non, Monsieur, il n'a pas voulu mettre pied à terre, il n'avait pas le temps.
3. Avez-vous mis cet insolent à la porte?
4. Non, Monsieur, mais je lui ai défendu de remettre le pied chez moi.
5. Avez-vous mis ces petits enfants à l'abri de la pluie?
6. Je les ai mis à l'abri de la pluie et du vent.
7. Avez-vous mis votre fils à même d'apprendre la médecine?
8. Je l'ai mis à même d'apprendre la médecine, s'il désire la faire.
9. Avez-vous mis votre habit à l'envers?
10. Je ne l'ai pas mis à l'envers, je l'ai mis à l'endroit.
11. Vous êtes-vous mis en colère?
12. Non, Monsieur, je ne me suis pas mis en colère.
13. Vous êtes-vous mis à table, hier à quatre heures?
14. Nous nous sommes mis à table à six heures.
15. Avez-vous l'intention de vous mettre en pension?
16. J'ai l'intention de me mettre en pension chez M. L.
17. Quand vous mettez-vous en voyage (route)?
18. Nous nous mettons en route demain matin.
19. Votre fils s'est-il mis à rire?
20. Non, Monsieur, il s'est mis à pleurer.
21. Pourquoi ne vous mettez-vous pas à travailler (à l'ouvrage)?
22. Parce que je vais me mettre à lire.
23. Cette dame se met-elle à l'anglaise?
24. Elle se met à l'italienne.
25. Ces dames sont-elles bien mises?
26. Elles sont mises à merveille.
27. Ne voulez-vous pas vous mettre à l'ombre?
28. Je me mettrai au soleil, j'ai très froid.
29. Votre habit est-il à l'envers?
30. Non, Monsieur, il est à l'endroit.
31. Est-ce là l'endroit de ce drap?
32. C'est l'envers.
33. N'êtes-vous pas mis à l'anglaise?
34. Je suis mis à l'italienne.
35. Vous êtes bien mis.

EXERCISE 135 (Vol. II., page 171).

1. Send for the physician, your little boy is sick.
2. We have already sent for him.
3. You do not want your pencil, lend it to me.
4. I cannot lend it to you, I am using it.
5. Give it to me, or lend it to me.
6. I have promised it to your teacher.
7. If you have not said it to him, tell him of it as soon as possible.
8. Do not tell him of it yet.
9. Speak to him about it the next time you see him.
10. Have patience, my friend, your father will not be long coming.
11. Obey your instructor.
12. I always obey him.
13. Give him a good part of it.
14. I have already given him more than two-thirds of it.
15. Have you carried that key to the locksmith?
16. I have forgotten to give it to him.
17. Take it to him, without fail, this afternoon.
18. Have the goodness to tell me where Mr. G. lives.
19. Take the first street on the left, he lives in the second house on the right.
20. Come, young ladies, let us make haste.
21. Take them thither as soon as possible.
22. Do not bring them back to me.
23. Send them back to me to-morrow.
24. Let us carry them thither.
25. Let us not carry them thither.
26. Lend them to him, but do not give them to him.

EXERCISE 136 (Vol. II., page 171).

1. Donnez un livre au jeune homme.
2. Je lui en ai déjà donné un, et il ne le lit pas.
3. Prêtez-le lui, si vous ne voulez pas le lui donner.
4. Je ne veux pas le lui prêter.
5. Dépêchez-vous, Mesdemoiselles, il est dix heures.
6. Veuillez me donner une plume.
7. J'en ai donné une à M. votre frère.
8. Obéissez à votre père et parlez à votre sœur.
9. N'envoyez-vous pas chercher la lettre?
10. Je l'envoierai chercher.
11. Envoyez la chercher aussitôt que possible.
12. Ne le faites pas, mais écrivez à mon cousin.
13. Allons, mes enfants, apprenez votre leçon.
14. Donnez-lui-en, ou lui en prêtez (or prêtez-lui-en).
15. Ne dépêchez pas, nous avons le temps.
16. Ayez patience, mon enfant, le marchand viendra bientôt.
17. Envoyez-le lui, si vous ne pouvez le lui donner.
18. Écrivez-lui, sans faute, cette après-midi.
19. Je lui écrirais si j'avais le temps.
20. Prenons la première rue à gauche.
21. Prenez la deuxième rue à droite.
22. Faites attention à ce que dit votre frère.
23. Disons la vérité.
24. Lisons ce livre aujourd'hui.
25. Payez vos dettes aussitôt que possible.
26. Obéissez à notre précepteur.
27. Portez-lui la clef.
28. Rappelez-moi les livres que je vous ai prêtés.
29. Ne me les rapportez pas, lisez-les.
30. Prenons patience, nous aurons bientôt de l'argent.
31. Parlons-leur, ils sont chez mon père.
32. Dites-leur que j'ai l'intention de leur écrire demain matin.
33. Allez à l'église cette après-midi.
34. Rappelez-moi mes lettres.
35. Ne les y portez pas, mais apportez-les-moi aussitôt que possible.

LESSONS IN CHEMISTRY.—XXII.

METALS PROPER—continued.

IRON—continued.

3. Refining.—Although "pig-iron" is used for casting, it is unable to be worked at the forge, and before it can become "wrought-iron" it must pass through two processes, in which all extraneous matter is removed. The *finery* into which the pig-iron is next introduced is a furnace, or forge, on the hearth of which it is melted, but not in contact with the combustible matter, which is usually coke; a double row of blast-pipes urgo the heated air, etc., from the burning coke over the hearth on which the pig-iron is placed, and thus it is melted. Fig. 51 will afford an easy explanation of this process. The iron is melted on the hearth, A, which is made of iron plates, which are kept cool by air being allowed to circulate freely around them. The fire is fed with coke through the door, D, and the iron is introduced by a side door in the wall, which has been taken away to exhibit this section; B are two of the blast-pipes; F is the *floss-hole*, out of which the slag, which floats on the melted iron, escapes as it rises over the partition. The following analyses will at once show the effect the refinery has on the cast-iron:—

	Carbon.	Silicon.	Phosphorus.	Iron.
Pig Iron . . .	3.0	4.5	0.2	92.3 = 100.0.
Refined Iron .	1.7	0.5	0.0	97.8 = 100.0.

The carbon and phosphorus are burnt out. Some of the iron is oxidised, and this, with the silicon, forms a fusible slag, and comes away through the floss-hole. The melted iron is run off into flat cakes about three or four inches thick, and is suddenly cooled by throwing water upon it. It has now lost the coarse grain of the pig-iron, and its colour is a silvery white.

4. Puddling is the last process by which the remaining silicon and carbon are separated from the iron. The refined iron is broken into pieces, and again melted in a reverberatory furnace, similar to the one drawn in Fig. 51. The melted mass is stirred with iron rods, upon the end of which it agglomerates, forming *blooms*. The rod is drawn from the furnace with this mass of white-hot molten paste adhering to it, and although it weighs some three-quarters of a hundred-weight, yet with the greatest ease and rapidity one or two men drag it to the *shingling press*, where a huge hammer descends upon it; again and again the pressman turns it under the blow of the hammer, which squeezes out the impurities, and welds the metal into a plate of "wrought-iron."

As fully as our space will permit, we have described the operation of reducing iron from the ore; but it must be remembered that the quality of the iron is affected by the least change in the fuel, the lime, or the quantity of air driven by the blasts, and that at every point of the process experience has suggested certain improvements, to understand which a work on metallurgy must be consulted.

Steel is a carbide of iron; it contains from 1.3 to 1.7 per cent. of carbon. The usual mode of manufacturing steel is to pack bars of wrought-iron in boxes of brickwork, with *cement powder*, which is a mixture of soot and salt. The boxes are so arranged that they can be elevated to a temperature which will melt copper, and can be maintained at that point for six or eight days; thus carbon is introduced into the iron. It will be evident that the exterior of the bar will be more highly carburized than the interior; hence the bars are melted in crucibles and cast into ingots, forming the *cast-steel* of which cutlery is made. Seeing that there is 3 per cent. of carbon in pig-iron, and none in wrought-iron, it is plain that if the process were stopped just at that point when the metal was combined with 1.5 of carbon we should have steel. Upon this principle Mr. Bessemer founded his process of making steel; he forces a quantity of air into the bottom of a cylinder full of melted "pig-iron," and thus burns out the carbon; the process is arrested just when the proper quantity of carbon remains to form steel. Bessemer's steel is largely used for rails of railways, and has almost entirely supplanted the use of wrought-iron, where hardness is required.

When steel is touched with a drop of nitric acid a grey spot appears, the acid dissolving the iron, and the carbon remaining.

Iron forms with oxygen three distinct oxides—ferrous oxide (FeO), ferric oxide or sesquioxide (Fe₂O₃), magnetic oxide, which is a compound of these (FeO, Fe₂O₃), and ferric acid (H₂FeO₄).

The first can never be obtained, for its great affinity for

oxygen causes it to unite with that element and become the next higher oxide; but in a hydrated form it is precipitated from any ferrous solution by potash.

Ferric oxide (Fe_2O_3) appears crystallised in nature as *specular iron ore*, and amorphous as *red hematite*. It may be prepared artificially by precipitation from a solution of ferric sulphate or chloride by ammonia, and heating the precipitate. Both the above oxides are bases for corresponding salts.

Ferrous sulphate ($\text{FeSO}_4 + 7\text{H}_2\text{O}$) is copperas or green vitriol; it is the result of the action of sulphuric acid on metallic iron. If it be permitted to absorb oxygen it changes colour, and becomes partially *ferric sulphate* (Fe_2SO_4). Green vitriol is used with astringent matters as a black dye. With gallic acid it forms ink.

Ferrous chloride (Fe_2Cl_6).—When iron is acted upon by hydrochloric acid, and solution evaporated, green crystals of this salt, containing four molecules of water of crystallisation, are formed.

Ferric chloride (Fe_2Cl_6) is produced when hydrochloric acid acts upon ferric oxide.

Ferric acid has never been prepared, it is very unstable; but if nitre and ferric oxide be fused together, potassium ferrate (K_2FeO_4) is formed. This metal forms many other salts, but they are of no great interest.

The *ferrous* or *protosalt* salts give green solutions; with alkalis they yield white precipitates, and a light-blue colour with potassium ferro-cyanide, which rapidly becomes dark. If their solution be slightly acid, sulphuretted hydrogen has no effect upon them.

Ferric or peroxide salts are of a reddish-brown colour, and such is the colour of their precipitate with the various alkalis.

Potassium sulpho-cyanide in neutral solutions gives a thick precipitate of a dark-red colour, similar to that of blood. Potassium ferro-cyanide affords a copious precipitate of a rich dark-blue colour.

It should be said that under the action of the blow-pipe both classes of salts act alike, namely, with them a borax bead becomes green in the reducing flame, which all but loses its colour when it is exposed to the oxidising flame.

TITANIUM.

SYMBOL, Ti — COMBINING WEIGHT, 50.

This is a rare metal, generally associated with iron. They appear together in *rutile*, and it would seem that a minute quantity of titanium is disseminated through the clay iron ore; for in the cindery coating of the crucible of a smelting furnace, after many years' work, there appear beautiful cubic crystals of a red metallic substance, which are found to be a compound of nitrogen and titanium. Though this metal is found with iron, it bears a close analogy to

TIN.

SYMBOL, Sn — COMBINING WEIGHT, 118 — SPECIFIC GRAVITY, 7.3.

The only ore of tin of importance is *tin-stone*, which is the binoxide of the metal (SnO_2); it is by no means widely distributed, only being worked in three or four localities. The mines of Cornwall furnished the Romans with their supply, and still yield 6,000 tons annually. The island of Banca, in the East Indies, is almost a block of very pure ore. Mexico also possesses tin mines. When a stream of water wears away the rock through which a vein of tin passes, the ore is found water-worn in the bed of the stream. This is the most valuable ore, and goes by the name of *stream-tin*. The reduction of the metal is easily accomplished, since the washed and pure ore has only to be submitted to heat in a reverberatory furnace, mixed with coal and a little lime. The ore gives up its oxygen to the coal, and the lime, with some silica, which is unavoidably present, forms a fusible slag. The metal sinks to the bottom of the furnace, and the slag swims on its surface.

Tin is a white brilliant metal, capable of being beaten out into "foil," and sufficiently ductile to allow of its being drawn

out into wire. When bent it emits a "crackling" noise. It melts at 235°Cent. , and can be volatilised, though with difficulty.

The air has but little effect on it; but when heated to a high temperature it combines with oxygen, burning brilliantly into a white powder, stannic oxide (SnO_2).

It is chiefly used in commerce as a covering to sheets of iron. The best iron is used, and by a series of processes is rendered chemically clean; the sheet is then immersed in melted tin, and an alloy is formed at the surface of the iron. The sheet is dipped a second time and the superfluous metal allowed to drain off.

If the surface of a sheet of tin be sponged with a mixture of two parts nitric acid, two of hydrochloric, and four of water, the crystalline appearance known as *moirée métallique* is produced. The plate must be gently heated before the application of the acid, and quickly plunged into water and varnished. Different effects may be produced by using coloured varnishes.

Alloys of Tin.—*Britannia metal* is equal parts of brass, tin, antimony, and bismuth. *Peewee* is 4 parts of tin and 1 of lead. *Solder* is 2 parts of tin and 1 of lead. *Bell metal* is 78 of copper and 22 of tin. *Gun metal* is 90 of copper and 10 of tin. *Bronze* contains less tin than gun metal, and usually 3 or 4 per cent. of zinc. *Speculum metal*, which admits of a high polish, and is used for the mirrors of reflecting telescopes, consists of 2 parts of copper and 1 of tin. For silvering mirrors, an amalgam of tin and mercury is employed. A sheet of tin-foil is laid on a level marble slab, and covered by clean mercury; the superfluous quicksilver runs into a groove cut in the stone round its edge. When the mercury remains on the foil in a layer of the thickness of half-a-crown, a perfectly dry and clean

sheet of glass is carefully slid over the mercury, beginning at one end of the slab by dipping the edge of the glass beneath the surface of the quicksilver—thus all air-bubbles are excluded; the glass is covered with flannel and weighted, the slab being inclined to allow the mercury to drain off. This inclination is increased until, in a month, the glass is vertical, and is then in a fit condition to frame.

Tin forms two oxides:

Stannous oxide (SnO) is prepared as a white hydrate, by precipitation from a solution of stannous chloride by an alkaline carbonate. When moist it absorbs oxygen, and becomes—

Stannic oxide (SnO_2), which is found as *tin-stone*. It may be artificially prepared by the action of nitric acid on tin, or by adding an alkali to a solution of a stannic salt. It is remarkable, that when prepared in the former way it is insoluble in hydrochloric acid, whereas, in the latter case, it is readily soluble.

When tin is treated with nitric acid, a white crystalline insoluble mass is formed—

Metastannic acid, which, when heated to 100°Cent. , parts with some of its water and becomes

Putty powder, which is much used in making enamels. These oxides of tin are of great use to the dyer as mordants.

Bisulphide of tin (SnS_2) is *mosaic gold*, a powder which closely resembles the precious metal, and is used in decoration.

The *purple of Cassius* appears when stannous chloride (SnCl_2) is added to a solution of chloride of gold.

TUNGSTEN.

SYMBOL, W — COMBINING WEIGHT, 184.

This metal, combined with iron, occurs in the mineral *wolfram*. It has been lately discovered that a little of it in steel greatly increases the hardness of that substance.

Tungstic acid (WO_3) is obtained as a yellow powder when native tungstate of lime, *scheelite*, is treated with nitric acid; with sodium, the tungstate of soda is formed, which is mixed with starch, and used by the laundress to render muslins, etc., unflammable.

Molybdenum and **Vanadium** are closely allied to tungsten, but, as yet, have no commercial value.

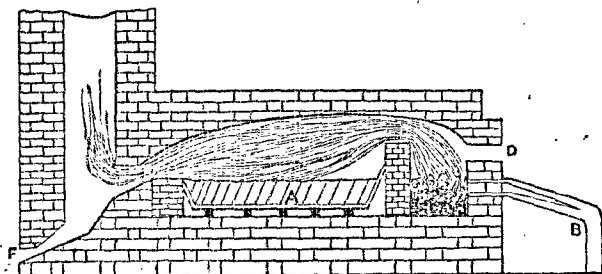


Fig. 51.—SECTION OF REFINING FURNACE.

LESSONS IN GEOLOGY.—VI.

VOLCANOES—IGNEOUS AGENCY.

THE universal action of water is to level. If the world continue for the requisite number of ages, and if no other cause interfere with the degrading and filling up which is carried on by every rain-drop, river, or ocean current, in due time our world will be a level plain. This, however, can never be the case, for there exists a force which constantly opposes the action of water. The Creator "hath set the one over against the other," and here, as in every domain of Nature, is a finely adjusted balance—the aqueous agency on the one hand, and the igneous agency on the other; the one wearing down, the other elevating; the one filling up and making the surface even, the other disrupting and throwing the existing arrangement into disorder.

The action of heat is exerted in three ways—(1) in volcanoes, (2) earthquakes, and (3) the gradual upheaving or subsiding of portions of the earth's crust. We are not able to trace the action of heat so certainly as that of water, for the simple reason that we can watch the one from first to last; whereas we can only study the effects of thermal action, and thence attempt to divine the causes.

Wherever there is room for speculation, no lack of speculators has been found; and upon almost every question upon which a doubt could exist—and there are many in this part of the subject—the geological world has been divided. We shall notice the prominent points of the various controversies as we discuss the subjects as they present themselves.

1. **Volcanoes.**—We shall find that rocks which owe their origin to igneous action may be safely divided into *plutonic* and *volcanic* rocks. In the former class are arranged all rocks of the primary formations, such as granites, etc., which are the offspring of a much more general and widely extended action than those igneous rocks which date from a much later period. These rocks, which are found within limited ranges, have been ejected from a *crater*, that is, a hole is formed from the surface to the bowels of the earth beneath,

up which is thrown molten lava and ashes, or *scoriae*. This matter is cast up and falls around the opening, forming a hillock, the top of which is a cup-like formation, at whose base is the mouth of the volcano. A mountain thus entirely formed of material ejected from the centre of action beneath, is called a *crater of eruption*. However, another method of construction of a volcanic mountain can be imagined, where some violent upheaving force lifts up the surface into a bubble-like mound; the apex, being naturally the weakest part, gives way, and from the opening thus formed the internal fires belch forth, and the eruption proceeds, the walls of the bubble falling down from the mountain. A volcano thus produced is styled a *crater of elevation*. These two theories have been energetically supported by eminent geologists. Scrope, Prevost, and Lyell are adherents of the *eruption* theory, whilst Humboldt, Elie de Beaumont, Dufrenoy, and others, maintain the theory of *elevation*. We shall find that there is some truth in each theory, but that no volcano owes its origin entirely to elevation or eruption, both processes having taken part in the erection of the mountain. It is supposed that all the volcanoes in the world are members

of four groups. The Andes, which edge the western shore of the American continent, present in their chain many active, and numerous extinct, burning mountains. This is the best defined volcanic group. A second is recognised as comprising the Aleutian Islands, Japan, the Moluccas, and the volcanoes of the East Indies. The third group includes those of the Pacific Archipelago; while the fourth is represented as stretching from Central Asia to the Azores, and includes the volcanoes of the Greek islands, and those of Southern Italy.

A remarkable fact will at once strike the observant reader, namely, that all volcanoes are in the immediate neighbourhood of the sea.

There is no exception to this rule. In Central Asia there is said to be a volcano on the north declivity of the Thian-Shan Mountains, but its last eruption is referred to the seventh century. There are not wanting evidences that in that part of Asia large bodies of water existed, and even now the large lake Issik-Kul is in the neighbourhood of the quiescent mountain. This apparent necessity of being in immediate proximity to water, caused Bischoff to propound a theory, which is generally accepted: that the immediate cause of volcanic action is due to the fact that water percolates through fissures in the surface down to the hot regions beneath; here it is made steam at a high pressure, and thus forces for itself a passage through the superincumbent crust, urging with it molten matter, and the debris caused in the upheaval of the strata, to produce a vent. Whether water be a requisite to volcanic action or not, one thing is certain, that no volcano can exist without heat.

Many geologists hold that the centre of the earth is still composed of molten matter, and that the lines traced by the volcano-chains mark the direction of vast fissures in the earth's crust up which, by the pressure of steam, the lava is forced. A grave objection at once appears to the acceptance of this assumption. If this be the case, according to the laws of hydrostatics, the pressure exerted at one point by the expanding steam must be felt by the whole liquid mass, for liquids transmit pressures equally in all directions; hence the same force which throws into action one volcano, must also

cause all the neighbouring cones to erupt. This argument finds a remarkable example in one of the Sandwich Islands. Mauna Loa is a volcano frequently active; there is a crater near its summit, 10,000 feet above the level of the ocean; 6,000 feet up one flank is another crater, Kilauea. It often happens, that while Loa is in action, the lava in Kilauea is molten, yet undisturbed. It seems an inevitable conclusion, that if these craters both derive their lava from the same reservoir, the force which propels the molten matter to the higher crater must cause a jet of lava to be thrown from Kilauea to a similar height.

That simultaneous disturbances would take place in each crater, if their ducts led to the same reservoir, may be fairly inferred from the fact, that we have numerous accounts of volcanic action occurring at the same moment at many distant

points: for example, a severe earthquake visited Chili in 1835; at the same moment the shock was felt over a wide area; the two volcanoes, Vantales and Osorno, burst into action; and at Juan Fernandez, 720 miles distant, a submarine eruption took place. Thus the commotion in some deep-seated reservoir affected a tract of country 900 miles long and 600 broad.

Fig. 10.

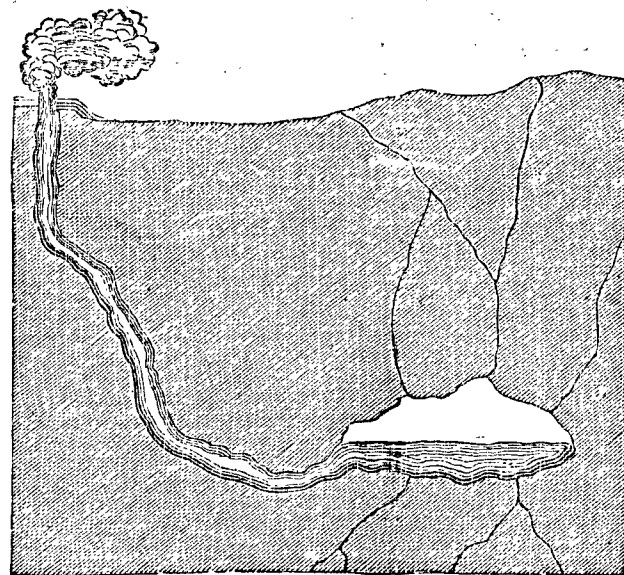


Fig. 11.

It has long been a theory pertinaciously adhered to, that the centre of the earth is now in a state of molten incandescence, and that all volcanoes derive their igneous action from the heated centre. In conjunction with the existence of burning mountains, another fact is adduced, which appears to give great weight to the supposition. It is generally found that in descending the crust of the earth the temperature increases. Numerous observations in mines and artesian wells have been made, and it is concluded that in England the thermometer rises 1° Fahr. for every 55 feet descended.

The reader must not suppose that this increase is at all uniform; indeed, Kupfer, from very extensive comparisons, infers that the increase is 1° Fahr. for every 37 feet, while Cordier gives the same augment of temperature for 45 feet. English geologists, from experiments made in this country, incline to the first-mentioned figure. Admitting that the temperature increases because we descend nearer to the heated nucleus, these differences might be reconciled by taking into consideration local causes, such as the conducting power for heat of the rock in which the mine or well was sunk—which would materially affect the observation—the proximity of the ocean, and other causes. But cases are recorded where the same mine has altered its temperature very considerably: for example, the Oatfield Mine, in Cornwall, 182 fathoms deep, had a temperature of 77° Fahr. while the mine was working. After the abandonment of the workings the temperature was reduced in a few months to 66°. In many months after, the equilibrium reached was almost that of the mean temperature of the surface. 54° Fahr.

It is clear that if the original high temperature were due to the central fire, the mere abandonment of the mine could not have reduced it. Presuming the increase of temperature, as we descend, be due to the approach of the central heat, at a depth of twenty-five miles a temperature sufficient to fuse such rocks as basalt and porphyry must exist.

The holders of this theory must, therefore, be prepared to admit that our globe has a crust of solid matter, whose thickness is represented in Fig. 10, by the breadth of the line C B; that is, if A B be the radius of the earth, 4,000 miles, the thickness of the curved line, $\frac{1}{10}$ of this, will represent the solid crust, all beneath being in a state of molten matter at a high temperature. This vast quantity of liquid cannot remain at rest, but must be traversed by currents, which would cause the temperature of the whole to be equalised; and it cannot be supposed that the mere shell would not be broken up and fused, and still more difficult is it to admit that it is possible that the proximity of such a mass at such a temperature would not affect the heat of the earth's crust, which it certainly does not. The answer given to these objections is, that we do not know the behaviour of solids under the influence of a high heat, and at the same time submitted to a great pressure; pressure may retard fusion, and that although at a high temperature, yet the rocks may not be molten; but the point of fusion must be reached a few miles further down, and therefore the objection is not removed. It is also urged that the earth's crust is a good non-conductor of heat, and instances of lava currents are adduced where the surface is solidified and tolerably good, and a few inches below the matter is still molten; but the cases are not parallel, the molten lava is only a dull red, and is at rest; moreover, in due time it will cool, whereas the temperature of the earth has not altered since the days of Hipparchus, who chronicled certain eclipses. Calculation has found that the times of those eclipses are correct, which proves that the length of the day has not altered for 2,000 years, that is, the rotation of the earth has not increased, which it must have done had the earth cooled, for then it would have contracted.

The late Mr. Hopkins attempted to calculate the thickness of the earth's crust from the influence which the moon exerts upon the earth, causing what is called the precessional motion of the earth's pole. He found that, assuming the earth to be a fluid nucleus enclosed by a solid shell, it was necessary that this should be at least 800 miles thick to cause the calculation to agree with observation.

The heat in mines, etc., can be well accounted for, without this "central heat theory," by chemical action. Freshly exposed surfaces, especially metallic lodes, are vigorously acted on by the oxygen of the air; heat is thus developed. This will account for an abandoned mine cooling down to the ordinary temperature

when the chemical action was exhausted. Moreover, we must remember that air in a condensed state acquires a lower specific heat, that is, its capacity for containing heat is decreased; hence an increment of heat will have a much greater effect in increasing the temperature at the bottom of a mine than on the surface. In the case of well-waters, the chemical action is induced by the gases they hold in solution acting upon the rocks through which they percolate, and on the sides of the subterranean reservoirs in which they collect. Sir Humphry Davy, Daubeny, and others, ascribe even volcanic heat to chemical action. The discoverer of the metals of the alkalis, potassium and sodium, supposed that at the base of burning mountains were vast deposits of these metals; that when water found its way to the metal it became decomposed, the metal retaining the oxygen, and the hydrogen being liberated, flamed out of the crater. The enormous scale of volcanic action, however, precludes the acceptance of this theory, and we must look for another cause of volcanic heat. Probably electricity has much to do with it; we know that electric currents traverse mineral lodes, and the Aurora Borealis proves that enormous quantities of electricity are in motion in and about the earth. If a powerful current were condensed by any cause, and forced to pass through a limited space, it would fuse the rock and supply the great necessary for the existence of a volcano. We have given a mere outline of these theories, and but very few of the facts by which they are supported. We refer the reader for further information to Lyell's "Principles of Geology," Daubeny on "Volcanoes," and Scrope's "Central France." There are 225 active volcanoes, or rather volcanoes which have been known to erupt within the last 150 years. The most remarkable European volcanoes are Vesuvius, Etna, Stromboli, one of the Lipari group, Santorin in the Greek Archipelago, and Hecla, in Iceland.

The products of volcanoes are of two kinds, lava and ashes. They are not always ejected at once. In the great eruption of Vesuvius, A.D. 79, when Herculaneum and Pompeii were buried, the mountain belched forth nothing but ashes, which so completely covered the doomed cities that their very site was unknown for ages. The first authentic account of a lava current from Vesuvius is in the year 1036.

Of the quantity of matter ejected by Vesuvius in the eruption of 79, history tells us that a shower of sand, lapilli, and pumice fell for eight days. Very few of the inhabitants perished in the overwhelming of their cities. The skeletons of two soldiers in the barracks of Pompeii were found chained to the stocks, and in the cellars in a villa in the suburbs of the city seventeen skeletons were discovered. The form of a Roman lady, with an infant in her arms, was imprinted in the rock, but nothing but the bones remained, which a chain of gold encircled, and the rings still adorned the fleshless fingers. Herculaneum is buried deeper than Pompeii, but was discovered first by the sinking of a well in 1713, which came down upon the theatre. An illustration of the height to which a volcano can eject ashes was afforded by one of the Mexican mountains in 1835, ashes from which fell in Jamaica, 700 miles distant, and must have been in the air four days.

In illustration of the rivers of lava which are poured out from the craters, we may quote the instance given by the Rev. T. Coan, of an eruption of Mauna Loa:—"From this yawning fissure, from two to thirty yards wide, the molten flood rushed out and spread laterally for four or five miles, filling ravines, flowing over plains, covering all from 10 to 200 feet deep—a lava current, including windings, seventy miles long."

The nature of volcanic rocks will be treated of in another place.

Before leaving this part of our subject, we must allude to the peculiar phenomenon exhibited in the Geysers, in Iceland. Whatever part steam may play in a volcanic eruption, there is no doubt but that the Geysers owe their action to its agency. The springs are thirty miles from the crater of Hecla: they are springs of hot water, which rise through a bed of lava with such force as to play in the air to a height of 200 feet for five or six minutes, then the column of water subsides into the basin, which is like a volcanic crater, and is in communication with a cavern beneath. The pipe of the Great Geyser descends perpendicularly 78 feet, and is from 8 to 10 feet in diameter. The eruption commences with a distant rumbling noise, which comes nearer, the water in the pool becomes agitated, and at length rises in a jet, with clouds of vapour and a loud explosion

It is remarkable that an eruption can be caused in some of the springs by throwing stones into their pipes.

The explanation of their action will be given by consulting Fig. 11. The water percolates through the rock, and collects in the cavern. Here it is heated by the volcanic fires; on account of the length of the pipe the water in the cavern is under great pressure, and hence its boiling point will be several degrees above 212° Fahr. When sufficient steam accumulates in the cavern it ejects the water from the pipe, and thus the liquid in the reservoir being relieved of its pressure generates a large quantity of steam suddenly, producing the eruption. When a stone is thrown into the pipe it disturbs the water, affecting the pressure, and giving an opportunity for more steam to be formed, which gives rise to the eruption.

READINGS IN GERMAN.—VII.

7.—Das Angebinde. Dass an"-gai-bin'-dai.

Als nun der Geburtstag des Waters herbeikam, da
Als nun der geburts-tag dess fah'-ters herr-by'-kahm, da
sammelten die drei jüngsten Sinter Blumen, die allerhöch-
sam'-mel-ten dee dry yunk'-sten kin'-der bloo'-men, dee al'-ler-shö'-n-
sten und ganz heimlich, und flochten sie, daß es der Vater nicht
sah, zum schönen Kranz und knüpfen die ganze Nacht fein
zab, tsööm shö'-nen kran'-tsai öönt kün'-ten dee gau'-tse nacht kine
Auge guthun.
ou'-gai tsou'-toon.

Als der Tag erwachte, gingen sie alle drei in das Kam-
Als der tag erwach'-tai, ging'-en zee al'-lai dry in dass kem'-
merlein mit bloßen Füßchen, daß es der Vater nicht hörte,
mer'-line mit blo'-ssen füß'-chen, dass ess dair fah'-ter nýt hö'-rai,
und trugen den Blumenkranz alle drei, und legten ihn
öönt troo'-ghen dain bloo'-men-kran'-ts al'-lai dry, öönt ley'-ten een
auf des Waters Bett ganz leise, daß es der Vater nicht
ouf dess fah'-ters bett ganz li'-zei, dass ess dair fah'-ter nýt
merkte. Der Vater merkte es wohl, aber er that, als
mer'-kal. Dair fah'-ter merck'-tai ess vole, al'-ber eyr thait, als
es er schlief.
öp eyr shlee'-fal.

Und als es nun Morgen war, da kam der Vater und
Und als es nun Morgen war, da kam der Vater und
sah die drei kleinen Blumenkranz und sagte: Wo sind die
sah tee drei kly'-nen bloo'-men-kran'-ts öönt zah'-tai: Vo zint dee
Engelchen, die mich bekränzen haben in der Nacht, da ich
eng'-ai-line, dee my'-hai-kran'-tsset hah'-ben in dair nacht, dah ty
schief! Und die Sinter kamen und hingen an ihm, küßten
shlee'-fal öönt dee kin'-der kün'-ten öönt hing'-en an een, küß'-ten
den Vater und waren voll Freude.
dain fah'-ter öönt vah'-ren föll froi'-dai.

Da kam ein Mann, ein Vetter, der brachte ein feines
Da kam ein mann, ein vete, der brach'-tai ein feines
rundes Kästlein mit Reifen; darinnen war schöner Wein von
rundes käß'-lein mit rei'-fen; da-rin'-nen wahr shö'-ner vine von
Schheim, das Herz des Waters zu erfreuen. Da war
shö'-heim, das hertz des waters zu erfreuen. Da war
Hoch-hime, dass herrts dess fah'-ters tsou err-froi'-en. Dah wahr
ter Vater erfreuet, als er sah, daß der älteste Sohn es
dair fah'-ter err-froi'-et, als eyr zab, dass dair el'-tai-stai zono ess
gefendet, und die Sinter tanzten um den Vater und das
gai'-zen-det, öönt dee kin'-der tants'-ten ööm dain fah'-ter öönt dass
Kästlein.
käß'-line.

Darnach trat der Vater an den Tisch und fand ein feines
Darnach trat der Vater an den Tisch und fand ein feines
großes Blatt, darauf war ein schöner und frommer Gesang
groß'-ess blat, dah-roof wahr ein shö'-ner öönt fröm'-mer gai'-sank'
von dem zweiten Sohne, der aus der Fremde heimgekommen
von dem zway'-ten söhne, der aus der fremde heimgekommen
war. Und als der Vater es las, da lächelte er und die
war. Und als der Vater es las, da lächelte er und die
vahr öönt als dair fah'-ter ess lah'-es, dah ley'-yel-tai eyr öönt dee
Sinter felen auf das Blatt.—Da sahen die drei Sinter den
trei'-nen fee'-len ouf dass blat.—Dah zah'-en dee dry kly'-nen dain
Vater an und sagten: Dieser Vater, nicht wahr? wir können
fah'-ter an öönt zah'-ten: Lee'-ber fah'-ter, nýt wahr? veer kön'-nen

nach nichts geben und nichts fertigen, wir sind noch so klein:
nach nýt's gley'-ben öönt nýt's ferr'-ti-ghen, veer zint noch so kly'-ne!
Da nahm der Vater alle drei, das Kästlein und die beiden
Da nahm dair fah'-ter al'-lai dry, dass meyyt'-line öönt dee bi'-den
Buben, und trüchte sie an sein Herz und sagte: O ge-
boo'-ben, öönt drück'-tai zee an zine herrts öönt zah'-tai: O gai-
tenet nicht, daß eure Gabe geringer sei in meinen Augen.
den'-ket nýt, dass oi'-rai gai'-bai gai'-king'-er zi in mi'-nen ou'-ghen,
Klopfen doch eure kleinen Herzelein so gut wie die andern
Klop'-fen doch oi'-rai kly'-nen herrts'-line zo goo't vee jee an'-deru
und mein Vaterherz für euch alle.
öönt mine fah'-ter-herrts' für ey al'-lai.

VOCABULARY.

Angebilde, n. keep- sake. (anbitten, to bind, attach.)	Befränzen, to cover with wreaths.	Heim, home.
Geburt, f. birth.	Küssen, to kiss. (Kuß, m. kiss.)	Nach der Fremde, from abroad. (Fremde, f. foreign parts.)
Blume, f. flower.	Woll, full.	Lesen, to read.
Flächten, to twist, twine.	Vete, m. messenger.	Wahr, true.
Kranz, m. wreath.	Tafel, n. cask, barrel.	Fertigen, to prepare, make. (fertig, ready.)
Zutun, to shut, close.	Wein, m. wine.	Bube, m. boy, lad.
Erwachen, to awake. (wachen, to be a- wake, to watch.)	Schheim, n. name of a place, from which Rhine wine was called Hook.	Knave.
Blöße, bare, merely.	Tanzen, to dance.	Drücken, to press.
Hören, to hear.	Tragen, to bear, carry.	Erkennen, to think, re- member. (denken, to think.)
Leise, softly.	Gefang, m. song, hymn.	Gabe, f. gift.
Engel, m. angel.	Blatt, n. leaf, sheet of paper.	Gering, trifling.

8.—Der hungrige Araber. Dair hönng'-ri-gai a'-ra-ber.

Ein Araber war verirrt in der Wüste. Zwei Tage hatte
Ein araber wahr verirrt in der wüste. Zwei tage hatte
ine a'-ra-ber wahr ferr-irrt in dair ru'-stai. Tsvi tah'-gai hat'-tai
er nichts zu essen und war in Gefahr, Hungers zu ster-
er nýt's tsou ess'-sen öönt wahr in gai'-fahr, hönng'-ers tsou shterr'-
ben, als er endlich eine von den Wassergruben antraf, an
ben, als er endlich eine von den wassergruben antraf, an
ben, als eyr ent'-ly'-i-nai fon dain vass'-ser-groo'-ben an'-traht, an
benen die Reisenden ihre Kameele tränken. Hier sah er
denen die reisenden ihre kameele tränken. Hier sah er
dey'-nen dee ri'-zen-den es'-rai ka-mey'-lai treng'-hen. Hier zah eyr
auf dem Sande einen kleinen steinernen Sack liegen. Gott sei
auf dem sande einen kleinen steinernen sack liegen. Gott sei
ouf, dain zan'-dai i'-nen kly'-nen ley'-der-nen sack lee'-ghen. Gott zi
geköst, sagte er, als er ihn aufhob und anfühlte; das
gailo'-pt', zah'-tai eyr, als eyr een ouf'-hope öönt an'-fal'-tai; dass
sind, glaube ich, Datteln oder Nüsse; wie will ich mich an ihnen
zint, glou'-bai ty, dat'-telu g'-der nüss'-sai; vee vill ty my'-en eo'-nen
erquicken und laden. In dieser süßen Hoffnung öffnete
err-quick'-ken öönt lah'-ben. In dee'-zer zü'-ssen höf'-nüss'-ak of'-nai-tai
er den Sack. Sah was er enthielt und rief voll Traurigkeit
eyr dain sack, zah vass eyr ent-heals' öönt reef föll trou'-riy'-kito
aus: Ach, es sind nur Perlen.
ouss: ach, ess zint noor perr'-len.

VOCABULARY.

Hungrig, hungry.	Trinken, to give to drink.	Laden, to comfort.
Sich verirren, to stray, to lose one's self.	Leinen, leather, of leather.	Erwartung, f. hope.
Wüste, f. desert.	Loben, to praise.	(hoffen, to hope, to wish.)
Gefahr, f. danger.	Auffehen, to lift up.	Enthalten, to contain, hold, to keep from.
Entlich, at last.	Anfühlen, to feel.	Woll, full (of).
Grube, f. pit.	Glauben, to believe.	Traurigkeit, f. sadness. (leid, affix, -ness.)
Antreffen, to find, meet.	Dattel, f. date.	Perle, f. pearl.
Reisende, m. travel- ler.	Erquicken, to refresh.	

KEY TO EXERCISES IN LESSONS IN GERMAN.

EXERCISE 116 (Vol. II., page 247).

1. I am nineteen years old, and in my twenty-third year I shall go with my father to England. 2. My eldest brother had invited twenty-five persons, among whom nearly half were married. 3. The company left us at a quarter to twelve. 4. Columbus discovered America in the year 1492. 5. A dozen contains twelve (pieces), and a pound contains thirty half ounces (German measure). 6. We bought three casks of oil, two pairs of shoes, and seven yards of cloth. 7. Thousands of Germans emigrate to America. 8. I have sold a hundred pens for half a dollar. 9. Shakespeare's birthday is the twenty-third of April.

10. Louis the Fourteenth was a lover of the fine arts and sciences. 11. The emperor died at twenty minutes past eleven. 12. I have been only twice in America, but the fourth time in England. 13. The Germans have had war with the French at different times. 14. The numbers four and nine have won threefold. 15. The battle of Waterloo was on the eighteenth of June, 1815. 16. Do you know how old that man is? 17. He is sixty years old. 18. This handsome horse is three years old, and that larger one is six. 19. What wine is this? 20. It is of the vintage of 1834. 21. I pay five per cent. interest for this capital. 22. Are there stags in this forest? 23. Yes, the huntsman shot one, sixteen years old, the day before yesterday.

EXERCISE 117 (Vol. II., page 247).

1. Mein Bruder hat hundert Bücher, und mein Onkel, der Professor, hat mehr als tausend. 2. Er stand gewöhnlich um halb sechs des Morgens auf, und arbeitete bis drei Viertel auf elf. 3. Ich habe sieben Monate bei ihm zugebracht. 4. Ich habe zwei Dutzend Federn und sieben Buch Papier verkauft. 5. Die Hälfte eines Gases ist er zu seinem Frühstück. 6. Dieses schöne Pferd ist fünf Jahre alt. 7. Der dritte Theil dieses Geldes gehört mir. 8. Ich vergab Ihnen einmal. 9. Sie thaten es zweimal. 10. Dieses Stück enthält ungefähr zwei und zwanzig Ellen. 11. Meine Schwester starb in ihrem sechsundzwanzigsten Jahre. 12. Kaufte sie in dem Jahre 1852 in Polen an der Cholera. 13. Die Flasche zwei und dreißiger (Wein) wird für einen Thaler verkauft. 14. Meine Schwester kaufte drei Ellen Band. 15. Rom wurde von Romulus sieben hundert und zwei und fünfzig Jahre vor Christi Geburt gegründet.

EXERCISE 118 (Vol. II., page 282).

1. Even the victors praised the valour of the conquered. 2. The song touched even the most inflexible hearts. 3. The strains of music reached even our ears. 4. Even here the children's joyful laughing can be heard. 5. How can one demand of others what he will not do himself? 6. One ought to esteem himself. 7. The weed grows by itself, without our sowing and attending to it. 8. Even poverty shall not hinder me from acting honestly. 9. If you also forsake me, then I have no longer a friend. 10. Oh that that time were already arrived! 11. Although he has a rough exterior, nevertheless he has a tender heart. 12. If you do this also, I will reward you well. 13. However many there are of you, I will enter into a contest with each of you. 14. However much Henry works, nevertheless he accomplishes nothing. 15. However much he spoke, nevertheless they did not hear him. 16. Whatever may happen, I shall remain faithful to him. 17. Whatever kind of news arrives, they do not become disheartened. 18. Whatever my friend begins, he has no success. 19. Whatever it may be, nobody shall hear it. 20. He has not even money enough to buy bread. 21. We must love everybody, even our enemies. 22. Even upon these conditions I cannot accept your proposal. 23. He could select even from all the books the most beautiful one.

LESSONS IN ITALIAN.—VI.

V.—PRONUNCIATION OF THE LETTERS C, G, S, IN COMBINATION WITH OTHER LETTERS.

It is necessary that I should now explain with some degree of minuteness certain peculiarities of the most frequent occurrence, and consequently of the highest importance in the pronunciation of the letters c, g, and s, when they enter into certain combinations with other letters.

With regard to the letters c and g, I have already stated and illustrated by examples in the first pronouncing table, that when c and g are placed before the vowels a, o, and u, c is sounded like k, and g like the English g in the words game, go, and gull. But suppose that it should be necessary in the declension of nouns, the conjugation of verbs, etc., to give to the c and g before the vowels e and i the same sound that c and g have before a, o, and u; it is obvious that some sign must be used to mark that pronunciation of the c and g, and avoid confusion. This sign is no other than the letter h, which, as has been remarked, is a mere soundless, written sign, and on that account pre-eminently suited to the purpose. In this way we arrive at the combinations ch and gh; and from what has been said it is obvious that the sound of ch before e and i can be no other than the sound of k; and the sound of gh before e and i, that of g in the English words game, go, and gull. And, indeed, it is a fundamental rule of Italian grammar, that whenever a grammatical necessity arises in the inflections or terminational changes of a word for retaining the sound of the c which in the root is sounded like k, and the sound of g which in the root is sounded like g in game, go, and gull, before the vowels e and i; h must be placed between c and g and the vowels e and i, and the combinations thus resulting will be che, chi, and ghe, ghi (pronounced kai or kè, kee; gai or ghè, ghee). For example,

banche (pronounced bahn-kai), banks, offices; stecchi (stèk-kee), thorns, prickles; Tedeschi (tai-dai-skee), Germans; Turchi (toor-kee), Turks; oche (ò-kai), geese; vecchie (vèk-keee), an old man; perche (per-kai), why; fianchi (feahn-kee), flanks, sides; Gherardo (gai-ráhr-do), Gerard; ghetto (ghét-to), a jowry; ghirlanda (ghirr-láhn-dah), garland; ghibellino (ghi-bel-lée-no), Ghibellin; alberghi (ahl-bèrr-ghee), hotels; maghe (máh-gai), sorceresses; impieghi (im-peè-ghee), employments.

But suppose a necessity arises for giving to the letter c before a, o, and u the sound of c in the word church, and to g before a, u, and o the sound of g in ginger. Evidently a sign must be used to indicate that, or else c would be sounded like k, and g like g in game. Now this sign is the vowel i. In common conversation this i is scarcely heard, serving the purpose only of a mere soundless written sign; but in the more measured or studied pronunciation of the pulpit, the stage, public assemblies and even frequently in the conversation of cultivated persons, the i is slightly touched in the enunciation, while the voice rapidly glides to the pronunciation of the vowels a, o, and u. Hence another fundamental rule of Italian, which goes side by side with the one above stated, that whenever a necessity arises for giving to the c before a, o, and u the compressed sound of c in the English word church, and to g before a, o, and u the compressed sound of g in ginger, the letter i (an auxiliary letter in this case) must be placed between c and the vowels a, o, and u, and between g and the vowels a, o, and u; and the combinations thus arising will be cia, cio, ciu, and gia, gio, giu, (pronounced tehah, tcho, tchoo, and jah, jo, joo). For example, ciascuno (tohah-skóo-no), everybody; ciancia (tehahn-tchah), foolery; cio (tchò), that, what; cioe (tchoè), that is to say; braccio (bráht-tcho), arm; ciuffo (tchóof-to), I catch, I snap; ciurma (tchóorr-mah), a mob, a crew of galley-slaves; giallo (jáhl-lo), yellow; giorno (jórr-no), day; giudice (jóo-dee-tchah), judge; giustizia (joo-stée-tzeeah), justice; giubilo (jóo-bee-lo), joy jubilee.

When c follows the letter s, thus forming the combination sc, and when at the same time it precedes the vowels a, o, and u, or the consonants t and r, it will be clearly apparent that the c in this case will follow the general rule, and be sounded like k; as sca, sco, scu, scia, etc., scri, etc. (pronounced skah, sko, skoo, sklah, etc., skree, etc.). When, however, the combination sc immediately precedes the vowels e and i, the sound of the c is less compressed than without the s before it; and sc in such cases is sounded like sh in English words. The combinations sce and sci will therefore be pronounced shai, sho, and shoo. But when c, with an s before it and with e or i to follow, is to retain the sound of k just as before a, o, and u, recourse is had to the same auxiliary letter h to indicate the preservation of the sound of c like k; and the combinations sche and schi are pronounced skai, or skè, and skee. When, on the other hand, c with an s before it, and with the vowels a, o, and u to follow, is to be pronounced not like skah, sko, skoo, but like sh, recourse must be had to the letter i, which is interposed between sc and a, o, and u, just as in those cases where, as we have seen, c standing by itself is to have the compressed sound of c in church before a, o, and u; and the combinations thus arising, scia, scio, and ciu, will be pronounced shah, sho, and shoo. The previous observation holds good in this case likewise, that in more studied pronunciation the letter i is in these combinations slightly touched, though the voice must rapidly glide to the enunciation of the vowels a, o, and u. Examples:—Scarpa (skáhr-pah), shoe; scoppiare (skop-péah-rai), to burst, crack; scuffia (skóof-feeah), a woman's cap; scherno (skèrr-no), mockery; schifare (skee-fáh-rai), to avoid, to have an aversion for; sciamare (sklah-máh-rai), to exclaim; scrivere (skree-vai-rai), to write; scelto (shòl-to), selected; scervo (shái-vro), separated; sciame (sháh-mai), a swarm of bees; coscia (kò-shah), thigh; sciolto (shòl-to), ungirded; sciocco (shòk-ko), stupid; asciutto (ah-shóot-to), dry.

The combinations gl, gn, and some others, I shall explain by notes, as they occur in the next pronouncing table, which illustrates several combinations of the letters c, g, and s.

FIFTH PRONOUNCING TABLE.

Italian.	1. Che, Chi, Ghe, Ghi.	
	Pronounced.	English.
Che	kai-to	Quiet.
Chino	kèc-no	Descant, bent.

Ghetto	ghét-to	Jewry.
Ghiro	ghée-ro	Dormouse.
Rachela	rah-kè-lai	Rachel.
Archimedeo	ahr-keè-mè-dai	Archimedes.
Voghera	vo-gai-ráh	He will row.
Bejvino	bei-ghée-no	Biggin, a child's cap.
Focha	fò-kai	Sea-calves.
Fichi	fée-keo	Fig-trees.
Leghe	lái-gai	Leagues, alliances.
Laghi	láh-ghee	Lakes.

2. Chia, Chic, Chio, Chiu.

I have explained the combination chi to be sounded like kee. When one of the five vowels follows this syllable, it is so intimately blended with the following vowel, that a kind of squeezed sound of chi is the result, the voice sliding, as it were, from chi to the next vowel with great rapidity.

Italian.	Pronounced.	English.
Chiavo	keeah-ro	Clear, bright.
Chiesa	keedi-zah	Church.
Chiodo	keed-do	Nail, I nail.
Chiuso	keeo-zo	Inclosed, inclosure.
Tarchiato	tahr-keeah-to	Plump, fat.
Banchiera	bahn-keeh-rai	Banker.
Melchiorre	mel-keeh-rrai	Melchior.
Conchiuso	kon-keeo-zo	Concluded.
Vecchia	vèk-keeah	An old woman.
Secchia	sèk-keai	Buckets.
Succhio	soók-keeo	Auger, juice.
Schiama	skeeo-mah	Proth, scum.

3. Ghia, Ghie, Ghio.

The remark made with respect to the syllable chi, followed by any of the five vowels, is equally applicable to the syllable ghi followed by a vowel: here, likewise, the syllable ghi is, as it were, squeezed, and the voice must slide into the pronunciation of the vowels that follow ghi with great rapidity.

Italian.	Pronounced.	English.
Ghiaja	gheeah-yah	Gravel, sand.
Ghiera	gheeh-rah	A ferrule.
Ghiera	gheeh-vah	Clod, turf.
Ringhiare	rin-ghieah-rai	To snarl.
Preghiera	prai-ghiee-rah	Prayer, desire.
Singhiotto	sin-ghiee-tso	Sob, sigh, hiccough.

The double zz, as well as the single z, may have the mild sound of the word adze (with which, by the bye, the ds in Switzerland. According to modern orthography, the letter z is generally doubled in the middle of words between two vowels, and the pronunciation of this zz scarcely differs from that of the single z. However, before diphthongs—as, for example, ia, ie, and io—must remain single, and has always, in such a case, the sharp sound. For example, ringraziare (rin-grah-tseeah-rai), to thank; pigrizia (pee-grée-tseeah), idleness; inezie (ee-nè-tseeah), follies; Bonifazio (Bo-neah-fah-tseeo), Boniface.

Cinghia	tchin-ghieeah	Girth.
Unghe	oon-ghieeah	Nails, hoofs.
Ringhio	rin-ghieo	I grin, grinding the teeth.

4. Cia, Cie, Cii, Cio, Ciu; Gia, Gie, Gii, Gio, Giu.

Italian.	Pronounced.	English.
Ciano	tcháh-no	Blue-bottle (plant).
Ciera	tchái-rah	The look, face.

The vowel i before e, when both follow the consonant c, is pronounced as though the i was not there, and the whole combination only ce. The same remark, however, made with regard to the combinations cia, cio, and ciu—that in a more measured enunciation the vowel i in these cases is slightly touched—holds good here also.

Ciofo	tchò-to	A mean fellow.
Ciuco	tchóo-ko	An ass.
Giarro	jáh-rah	Jar.
Gielo	jè-lo	Ice, frost, cold.

The observation just made in the foregoing note with respect to cie is strictly applicable to the syllable gie. It is always pronounced as though the i was not there, unless slightly touched in measured pronunciation.

Giove	jò vai	Jove, Jupiter.
Giuda	jóo-dah	Judah.
Baciare	bah-tcháh-rai	To kiss, salute.

Arciere	ahr-teeè-rai	Bowman, archer.
Arcione	ahr-tchóo-nai	Saddle-bow, saddle.
Acciuga	ah-tel-óo-gah	Anchovy.

No observation has yet been made in reference to the pronunciation of the double c (cc). This depends, as well as the pronunciation of double g (gg), on the vowel that follows the latter c. If that vowel is a, o, or u, the cc is sounded like a double k (kk) or ck. For example, bocca (bók-kah), mouth; becco (bèk-ko), beak; accusare (ahk-koo-záh-rai), to accuse. If, however, that vowel which follows the letter c is e or i, the double c (cc) is sounded something like tch in the English word match, only perhaps stronger, and with vibration. On that account, I have tried to imitate the stronger sound of the cc by the letters tch, placing the first t in the first syllable, and tch at the beginning of the second, just as I have attempted to imitate the sound of the gg by placing d in one syllable and j at the beginning of the next in such words as paggi (páhd-jee), pages, attendants. The remark with respect to the pronunciation of the gg, however, holds good of cc; the voice must not pause too long on the t of the syllable where the first c occurs, and glide as quickly as possible to the pronunciation of the second c, which must be very much vibrated. In this way a more equal distribution of the sound tch between the two syllables will be effected, which will produce the correct sound of the cc; and my imitation of that sound by tch has no other object than to indicate to the reader the necessity of giving a stronger vibration to the cc. It is obvious that when cc is followed by consonants, it must be pronounced like k, just as the single c in the like case must be so pronounced. For example, acclamare (ahk-klah-máh-rai), to elect by acclamation, to applaud; accrescere (ahk-kraí-shai-rai), to increase, etc. When between the cc and the vowels e or i the letter h is interposed, the cc is also sounded like k, as well as the single c in such cases and for the same reasons, the h being a mere auxiliary letter to indicate that cc before e and i is not to have the sound of tch, but of kk, as in chichera (kik-kai-rah), a tea-cup; chiacchiera (keeahk-keeah-rai), chit-chat.

Fagiano	fah-jáh-no	Pheasant.
Rugiero	roo-jè-ro	Roger.
Ingiusto	in-jóo-sto	Unjust.
Pancia	páhn-tchah	Belly, paunch.
Specie	spè-tchai	Kind, species.
Lercio	lèrr-tcho	Dirty, foul.
Ciufo	tchóof-to	I catch or snap.
Regia	rè-jah	Royal palace.
Ruggia	róod-jo	Roaring.
Giulio	jóo-leeo	A Roman coin, July.

5. Qua, Que, Qui, Quo; Qua, Que, Qui, Quo.

Italian.	Pronounced.	English.
Quale	gwáh-do	A ford.
Guelfo	gwèl-to	A Guelph, an ancient coin of Florence.
Guida	gwée-dah	Leader, guide.
Seguo	sè-gwo	I follow or pursue.
Quasi	kwáh-zee	Almost, as if.
Questo	kwái-sto	This.
Quito	kwée-to	I acquit, free.
Quojo	kwó-jo	Leather, skin.
Seguace	sai-gwáh-tchai	Follower, disciple.
Insegue	in-sè-gwai	He pursues.
Inguine	in-gwè-mai	Groin.
Liquori	lee-qwó-reo	Liquors.
Aquario	ah-kwáh-reo	Aquarius.
Loquela	lo-kwè-lah	Speech.
Aquila	áh-qwee-lah	Eagle.
Aquoso	ah-qwó-so	Aqueous, watery.
Lingua	lin-gwah	Tongue, language.
Sanguis	sáhn-gwai	Blood.
Pingue	pín-gwai	Fat, plump.
Pasqua	páh-skwah	Easter.
Cinque	tchin-kwai	Five.
Iniquis	ee-née-kwo	Unjust, iniquitous.
Adequi	ah-dè-kwoe	Thou comparest.

6. Cla, Cle, Cii, Clo, Ciu; Gla, Gle, Gli, Glo, Glu.

Italian.	Pronounced.	English.
Clava	kláh-rah	Club.
Clero	klè-ro	Clergy.
Clima	kleé-mah	Climate.
Cloto	klò-to	Cloth, one of the Fates.
Clasio	kleó-zeeo	Clasium, a town.
Cladio	gláh-deco	Sword, poniard.

This is the first occurrence in these lessons of the important combination *gl*. It has two different sounds. When it is not followed by the letter *i* it has the sound of *gl* in *gland*, *glebe*, *glory*, *glue*; and this sound can offer no difficulty. But when the combination *gl* is followed by the letter *i* and one of the vowels *a*, *e*, *o*, and *u*, it is pronounced precisely as the double *l* (*ll*) in the French words *bouilli*, *filé*, *grésille*, *grenouille*, *bouillon*, *billard*, *billet*, *brouillon*, *feuillu*, and, generally speaking, in all those words where the *ll* has after the vowel *i* a squeezed sound in the French language. They who are unacquainted with French may form a notion of this sound by separating and inverting the *gl* in the enunciation, that is, by pronouncing *ll* before the *g*, and changing the latter into *y*. Only the first *l* must go to one syllable, and the second *l* along with the *y*, and with a squeezed sound to the beginning of the next, while care must be taken that the voice should glide steadily from one syllable to the other, by which means a more equal distribution of the squeezed sound *ll* will be produced, and a correct pronunciation of the *gl* effected. An approximation to this sound may be found in the English words *million*, *military*, *biliary*, *billiards*, *seraglio*, *intaglio*, and *oglio*. The letter *i*, between the combination *gl* and the vowels *a*, *e*, *o*, and *u*, is (as well as in the combinations *cia*, *cio*, *civ*, and *gia*, *gio*, *giu*) a mere auxiliary letter, i.e., a mere soundless written sign, to indicate that *gl* before *a*, *e*, *o*, and *u* is not to have the sound of *gl* in *gland*, *glebe*, *glory*, and *glue*, but that squeezed sound, the imitation and description of which I have here attempted.

Globa	glô-bah	Clod of earth.
Glyfo	gli-to	Glyph (in architecture).
Globo	glô-be	Globe.
Gloria	glô-mah	Chaff.
Reclamo	rai-klâh-mo	Reclamation.

For example: *voglio* (vâhl-lyo), a sieve; *moglio* (mêl-lyo), better; *piglio* pil-lyo), I take, seize; *miscoglio* (mis-kôol-lyo), mixture; *svegliare* (zvel-yâh-rai), to awake; *togliere* (tôl-lyai-rai), to take away; *scegliere* (shêl-lyai-rai), to choose; *doglià* (dôl-lyah), sorrows; *bigliardo* (bil-yâhrr-dô), billiards; *biglietto* (bil-lyê-tô), note, bill; *imbrogliare* (im-brol-lyô-nai), a meddling fellow; *fogliuto* (fol-lyô-tô), full of leaves. *Egli*, he; *eglino*, they; *quegli*, that one; *gli* (the plural of the article or the pronoun), with its numerous compositions, and *gli*, the final inflection or terminational syllable of nouns and verbs, have always the squeezed sound *ll*ee; while the mere syllable *gli*, at the commencement and in the middle of words, always has the sound of *gl* in *gland*, *glebe*, etc. The only exception is *Angli*, Englishmen, (pronounced âhn-gee). For example: *figli* (fil-lyee), sons; *fogli* (fôl-lyee), leaves of paper; *gigli* (jil-lyee), lilies; *negliere* (nai-gee-jai-rai), to neglect; *negligente* (nai-gee-jên-tô), negligent; *negligenza* (nai-gee-jên-tsah), negligence; *negligentare* (nai-gee-jên-tâh-rai), to neglect.

LESSONS IN ALGEBRA.—VIII.

DIVISION (continued).

DIVISION BY COMPOUND DIVISORS.

[Art. 106, continued].—EXAMPLE.—Divide $ac + bc + ad + bd$, by $a + b$.

Here, arranging the quantities for division as we do in common arithmetic, we have—

Divisor $a + b$) $ac + bc + ad + bd$ ($c + d$ Quotient.
 $ac + bc$, the first subtrahend.

* $ad + bd$
 $ad + bd$, the second subtrahend.

Here ac , the first term of the dividend, divided by a , the first term of the divisor [Art. 92], gives c for the first term of the quotient. Multiplying the whole divisor by this term, we have the product $ac + bc$, which is to be subtracted from the two first terms of the dividend. The two remaining terms are then brought down, as in arithmetical division, and the first of these divided by the first term of the divisor, as before, gives d for the second term of the quotient. Then multiplying the whole divisor by d , we have the product $ad + bd$, which is to be subtracted from the remaining term of the dividend; as no remainder is left, the division is complete.

This operation suggests the following rule, which is founded

on the principle that the product of the divisor into the several parts of the quotient is equal to the dividend. [Art. 92.]

107. Rule.—Arrange the terms so that the letter which is in the first term of the divisor shall also be in the first term of the dividend. If this letter is repeated as a factor, either in the divisor or dividend, or in both, the terms should be arranged in the following order: put that term first which contains this letter the greatest number of times as a factor; then the term containing it the next greatest number of times, and so on.

EXAMPLE.—Divide $2aab + bbb + 2abb + aaa$ by $aa + bb + ab$.

If we take aa for the first term of the divisor, the other terms must be arranged according to the number of times a is repeated as a factor in each. Thus—

Divisor $aa + ab + bb$) $aaa + 2aab + 2abb + bbb$ ($a + b$ Quotient.
 $aaa + aab + abb$
 $aab + abb + bbb$
 $aab + abb + bbb$

In division, it is necessary that the strictest attention be paid to the rules for the signs in subtraction, multiplication, and division.

EXERCISE 8.

Perform the following exercises in division:—

1. $ax - 2xy + yy + x - y$.
2. $aa - bb - a + b$.
3. $bb + 2bc + cc + b + c$.
4. $aaa + xxx + a + x$.
5. $2ax - 2aax - 3aay + 6aax + axy - xy + 2a - y$.
6. $a + b - c - ax - bx + cx + a + b - c$.
7. $ac + bc + ad + bd + x + a + b$.
8. $ad - ah + bd - bh + y + d - h$.

108. From the preceding principles and examples we derive the following

GENERAL RULES FOR DIVISION.

- (1) Division, in all cases, may be expressed by writing the divisor under the dividend in the form of a fraction.
- (2) When the divisor and dividend are both simple quantities, and have letters or factors common to each: divide the coefficient of the divisor by that of the dividend, and cancel the factors in the dividend which are equal to those in the divisor.
- (3) When the divisor is a simple, and the dividend a compound quantity: divide each term of the dividend by the divisor as before; setting down those terms which cannot be divided in the form of a fraction.
- (4) If the divisor and dividend are both compound quantities, arrange the terms according to Art. 107.
- (5) To obtain the first term in the quotient, divide the first term of the dividend by the first term of the divisor. Multiply the whole divisor by the term placed in the quotient; subtract the product from the dividend; and to the remainder bring down as many of the following terms as shall be necessary to continue the operation. Divide again by the first term of the divisor, and proceed as before, till all the terms of the dividend are brought down. If the signs in the divisor and dividend are alike, the quotient will be +; if unlike, the quotient will be —.

EXERCISE 9.

1. Divide $12aby + 6abx - 18bbm + 24b$ by $6b$.
2. Divide $16a - 12 + 8y + 4 - 20ax + m$ by 4 .
3. Divide $(a - 2h) \times (3m + y) \times x$ by $(a - 2h) \times (3m + y)$.
4. Divide $ahd - 4ad + 3ay - a$ by $hd - 4d + 3y - 1$.
5. Divide $ax - ry + ad - 4my - 6 + a$ by $-a$.
6. Divide $amy + 3my - may + am - d$ by $-dmy$.
7. Divide $ard - 6a + 2r - hd + 6$ by $2ard$.
8. Divide $6ax - 8 + 2ry + 4 - 6hy$ by $4axy$.
9. Divide $16abcc - 12xyab + 24abrd - 36ahgb$ by $4ab$.
10. Divide $21aaby + 42cdzax + 14aaa - 35aaab$ by $7aa$.
11. Divide $12abxyz - 6hdabwy + 24xyghm$ by $3abxy$.
12. Divide $3ax - 36bx + 42 - 72cx + 30ax$ by $3x$.
13. Divide $40ab - 4(x + y) + 72 + 12(a + b) + 48c$ by -4 .
14. Divide $abx - cdz + 8yz + x$ by $ab - cd + 8y + 1$.
15. Divide $24xyz - 36cd - 48abd$ by $12xyz - 18cd - 24abd$.
16. Divide $-ab - ad + ax(a + b) - 42axy + ab$ by $-a$.
17. Divide $6am - 10ah + 20 - 12cd + 17a$ by $-2am$.
18. Divide $xyz + 6x + 2z - 1 + 2xyz(a + b)$ by $6xyz$.
19. Divide $-6ac - 12bc - 6ab - 10 - 2aabcc$ by $-6abc$.
20. Divide $18abyx + 16abx - 20bbcm + 24ab$ by $2b$.
21. Divide $16x - 24 + 8a + 42 - 20ax - a$ by -4 .

22. Divide $(x - y) \times (3a + x) \times b \times y \times (x - y) \times (3a + x)$.
23. Divide $41d \times (4 - a) \times (4 - y)$ by $(4 - a) \times 41d$.
24. Divide $-40xy + 7abx - 3ahmx$ by $-40y + 7ab - 3ahm$.
25. Divide $20(ab + 1) - 60(ab + 1) + 50(ab + 1)$ by $5a$.
26. Divide $6ax + 2xy - 3ab - dy + 3ac + cy + h$ by $3a + y$.
27. Divide $aab - 3aa + 2ab - 6a - 4b + 12$ by $b - 3$.
28. Divide $bb + 3bc + 2cc$ by $b + c$.
29. Divide $8aacb - 4bb$ by $2ab - bb$.
30. Divide $xxx - 3axx + 3ax - aaa$ by $x - a$.
31. Divide $2yyy - 19yy + 26y - 16$ by $y - 8$.
32. Divide $xxxxx - 1$ by $x - 1$.
33. Divide $4xxxx - 9xx + 6x - 3$ by $2xx + 3x - 1$.

The preceding rule may be thus summed up:—Divide every part or term of the dividend by the whole divisor, and collect the results as in addition; the sum will be the quotient.

EXERCISE 10.

1. Divide ab^2c^3 by abc , and x^2y^3 by x^2y .
2. Divide $x^m + n$ and x^{m-n} each by x^n .
3. Divide $a^2x^4 - a^2x + a^2x^3$ by a^2x^2 .
4. Divide $2a^3 - 3a^2y - 6a^2y^2$ by $3a^2$.
5. Divide $3a^2b^3 - 10a^2b^4 + 8a^2b^5$ by $3a^2b^3 - 4a^2b^4$.
6. Divide $x^4 - 13a^2x^3 + 12a^2x^2$ by $x^2 + 3ax - 4a^2$.
7. Divide $x^4 - 9a^2x^2 + 12xy^3 - 4y^4$ by $x^2 - 3xy + 2y^2$.
8. Divide $x^4 - 6x^3 + 5x^2 + 12x + 4$ by $x^2 - 3x - 2$.
9. Divide $x^3 + a^2$ by $x - a$.
10. Divide $a^2 - b^2 + 2bc - c^2$ by $a + b - c$.
11. Divide $81x^4 + 21x^3$ by $3x^2 + 2x$.
12. Divide $x^3 + a^3$ by $x^2 + a^2$.
13. Divide $10y^4 - 23ay^3 + 4a^2y^2$ by $5y^4 - 4ay^3 + a^2y^2$.
14. Divide $7x^4 - 26x^3 + 50x^2 - 74x + 35$ by $x^3 - 3x^2 + 5x - 7$.
15. Divide $2x^4 - 3x^3y + 2x^2y^2 + y^4$ by $x - 4y$.
16. Divide x^3 by $x^2 + 2x + 1$.
17. Divide x^3 by $x^2 - 2x + 1$.
18. Divide $x^4 - 8x + 7$ by $x^2 - 3x + 2$.
19. Divide $5x^4 - 6ax^3 - 2a^2x - a^4$ by $x^2 - ax + a^2$.
20. Divide $x^5 - 3x^4y + 3x^3y^2 - y^5$ by $x^3 - 3x^2y + 3xy^2 - y^3$.
21. Divide $3x^4 - 37x^3 + 35x^2 + 7x + 2$ by $x^3 + 3x^2 - 4x - 2$.
22. Divide $9a^2b + 9a^2bc - 4ab^3 + 4b^3c - 9abc^2 - 9bc^2$ by $3a - 2b + 3c$.
23. Divide $a^3 + 3a^2b + 3ab^2 + 2b^3 + 3b^2c + 3bc^2 + c^3$ by $a + 2b + c$.
24. Divide $4x^5 - x^3 + 4x$ by $2x^2 + 3x + 2$.
25. Divide $x - 9x^2 + 8x^3$ by $1 - 2x + x^2$.

GREATEST COMMON MEASURE.

109. A common measure of two or more quantities is a quantity which will divide or measure each of them without a remainder. [Art. 30.] Thus $2d$ is a common measure of $12d$, $6d$, $8d$, etc.

110. The greatest common measure of two or more quantities is the greatest quantity which will divide these quantities without a remainder. Thus $6d$ is the greatest common measure of $12d$ and $18d$; and 8 is the greatest common measure of 16 , 24 , and 32 .

111. To find the greatest common measure of two given quantities.

Rule.—Divide the greater of the given quantities by the less, the divisor by the remainder, and every successive divisor by its own remainder, until nothing remains; the last divisor will be the greatest common measure.

112. To find the greatest common measure of three or more quantities.

Rule.—Find the greatest common measure of any two of them; then the greatest common measure of that one and another of the quantities, and so on, till all the quantities have been employed in the operation; the last divisor is the greatest common measure.

The greatest common measure of two quantities is not altered by multiplying or dividing either of them by any quantity which is not a divisor of the other, and which contains no factor which is a divisor of the other.

The common measure of ab and ac is a . If either be multiplied by d , the common measure of abd and ac , or ab and acd , is still a . On the other hand, if ab and ac are the given quantities, the common measure is a ; and if acd be divided by d , the common measure of ab and ac is a .

113. Hence, in finding the common measure by division, the divisor may often be rendered more simple by dividing it by some quantity which does not contain a divisor of the dividend. Or the dividend may be multiplied by a factor, which does not contain a measure of the divisor.

EXAMPLE.—Find the greatest common measure of $6a^2 + 11ax + 3x^2$ and $6a^2 + 7ax - 3x^2$.

$$\begin{array}{r} \text{Here, } 6a^2 + 7ax - 3x^2 \quad 6a^2 + 11ax + 3x^2 \quad (1) \\ \underline{6a^2 + 7ax - 3x^2} \\ 4ax + 6a^2 \text{ Remainder.} \end{array}$$

Now dividing this remainder by $2x$, we have $2a + 3x$ for the next divisor.

$$\begin{array}{r} \text{Divisor.} \quad \text{Dividend.} \quad \text{Quotient.} \\ 2a + 3x \quad 6a^2 + 7ax - 3x^2 \quad (3a - x) \\ \underline{6a^2 + 9ax} \\ -2ax - 3x^2 \\ \underline{-2ax - 3x^2} \\ 0 \end{array}$$

The first remainder was divided by $2x$ because it is a common factor of both terms of that remainder, and it cannot form a factor of the common measure, not being a factor of every term in the proposed quantities. As the division of the preceding divisor by this simplified remainder leaves no remainder, therefore $2a + 3x$ is the common measure required.

EXERCISE 11.

1. Find the greatest common measure of $a^3 - b^2x$ and $a^2 + 2bx + b^2$.
2. Find the greatest common measure of $cx + x^2$ and $a^2c + a^2x$.
3. Find the greatest common measure of $3a^3 - 24x - 9$ and $2x^3 - 16x - 6$.
4. Find the greatest common measure of $a^4 - b^4$ and $a^4 - b^2a^2$.
5. Find the greatest common measure of $a^3 - 1$ and $xy + y$.
6. Find the greatest common measure of $a^3 - a^2$ and $x^4 - a^4$.
7. Find the greatest common measure of $a^2 - ab - 2b^2$ and $a^2 - 3ab + 2b^2$.
8. Find the greatest common measure of $a^4 - x^4$ and $a^3 - a^2x - ax^2 + x^3$.
9. Find the greatest common measure of $a^3 - ab^2$ and $a^2 + 2ab + b^2$.

LEAST COMMON MULTIPLE.

114. A common multiple of two or more quantities is a quantity which can be divided by each of them without a remainder. Thus $12ab$ is a common multiple of $4a$ and $6b$; or of $3a$ and $2b$, etc.

115. The least common multiple of two or more quantities is the least quantity which can be divided by each of them without a remainder. Thus $12abc$ is the least common multiple of $4a$, $3b$, and $6c$.

116. To find the least common multiple of two or more given quantities.

Rule.—Reduce the given quantities to their prime factors; find the product of the greatest powers of these factors, and it will be the least common multiple required.

EXAMPLE.—Find the least common multiple of $(a + x)^2$, $a^2 - x^2$, and $(a - x)^2$.

Here, the prime factors of the quantities are $(a + x)^2$, $(a + x)$, $(a - x)$, and $(a - x)^2$; now of these factors, which are different powers of $a + x$ and $a - x$, the first and last contain their highest powers; therefore, according to rule, $(a + x)^2(a - x)^2 = (a^2 - x^2)^2$ is the least common multiple of the quantities required.

EXERCISE 12.

1. Find the least common multiple of bc , ce , and by .
2. Find the least common multiple of a^2b^3 and a^2b^2 .
3. Find the least common multiple of $2ab$, $3bc$, $4cd$, $5dc$, and $6cf$.
4. Find the least common multiple of $(a + b)^3$, $(a^2 - b^2)$, $(a - b)^2$, and $(a - b)^3$.
5. Find the least common multiple of $6a$, $9a^2$, and $4a^3$.
6. Find the least common multiple of $a^3 - x^3$ and $a^3 - x^2$.
7. Find the least common multiple of $(x - a)$, $(x + a)$, $(x^2 - a^2)$, and $(x^2 + a^2)$.

KEY TO EXERCISES IN LESSONS IN ALGEBRA.

EXERCISE 7.

- | | |
|----------------------------|------------------------|
| 1. $\frac{hx}{y}$ | 7. $-m - \frac{3y}{5}$ |
| 2. $\frac{hm - 3y}{b}$ | 8. $y + \frac{dh}{2a}$ |
| 3. $\frac{a + x}{y}$ | 9. 1. |
| 4. $\frac{am}{xy}$ | 10. 1. |
| 5. $dy + r - \frac{hd}{x}$ | 11. 1. |
| 6. $2x + d + \frac{x}{a}$ | 12. $a + 1$. |
| | 13. $b - 1$. |
| | 14. $xy - 1 + 2d$. |
| | 15. $cb + 1 - 2m$. |
| | 16. 5. |
| | 17. $\frac{1}{b}$. |

(1)

No.	When recd.	From whom received.	By whom drawn.	On whom drawn.	To whom payable.	Date.	Time.	When due.	Sum.	How and when disposed of.
	1881.					1881.		1881.	£	
610	Sept. 6	R. O'Brien & Co.	R. O'Brien & Co.	Kennard & Co.	White, Smith, & Co.	Aug. 5	3 months	Nov. 4	1000	Cash, Nov. 4
611	" "	do.	do.	J. Harris	do.	" 7	" "	Oct. 8	580	do. Oct. 8
612	" "	do.	do.	W. Melville	do.	" "	" "	Nov. 10	875	do. Nov. 10
613	Oct. 3	P. Hutchinson & Co.	P. Hutchinson & Co.	T. Salomons	White, Smith, & Co.	Aug. 12	2 months	Oct. 15	2456	Cash, Oct. 15
614	" "	do.	do.	J. Sidney	do.	" 18	" "	" 21	150	do. " 21
615	" "	do.	do.	L. Dixon	do.	" 20	" "	" 23	120	do. " 23
616	" "	do.	do.	W. Turner	do.	" 22	" "	" 25	170	do. " 25
617	" "	do.	do.	D. Hoole	do.	" 24	" "	" 27	200	do. " 27
618	" "	do.	do.	D. Hughes	do.	" 26	" "	" 29	140	do. " 29
619	" "	do.	do.	R. Payne	do.	" 28	" "	" 31	200	do. " 31
620	" "	do.	do.	T. Devan	do.	" 30	" "	" "	200	do. " "
621	" "	do.	do.	N. Allison	do.	" 31	" "	" "	200	do. " "
622	" "	do.	do.	S. Stone	do.	" "	" "	" "	200	do. " "
623	" "	do.	do.	B. Hulme	do.	" "	" "	" "	400	do. " "
624	" "	do.	do.	W. Alexander	do.	" "	" "	" "	576	do. " "
625	" "	do.	do.	R. Kirkman	do.	" "	" "	" "	200	do. " "
626	" "	do.	do.	T. Griffiths	do.	" "	" "	" "	200	do. " "
627	" "	do.	do.	N. White	do.	" "	" "	" "	100	do. " "
628	" "	do.	do.	W. Currie	do.	" "	" "	" "	350	do. " "
629	" "	do.	do.	J. Overton	do.	" "	" "	" "	135	do. " "
630	" "	do.	do.	W. O'Callaghan	do.	" "	" "	" "	4051	do. " "
631	" "	do.	do.	T. Charrington	do.	" "	" "	" "	260	Cash, Dec. 27
632	Nov. 1	T. Brown & Co.	T. Chandler	W. Coles	White, Smith, & Co.	Oct. 24	2 months	Dec. 27	0	

BILLS PAYABLE.

(1)

No.	When acdpt.	For whom accepted.	By whom drawn.	To whom payable.	Where payable.	Date.	Time.	When due.	Sum.	How and when disposed of.
	1881.					1881.		1881.	£	
140	Aug. 23	R. Hastie & Co.	R. Hastie & Co.	Williams & Co.	London	Aug. 13	3 months	Nov. 16	60	R. Hastie & Co., Nov. 16
141	" 25	N. Herschell	do.	T. Riley	do.	" 14	" "	" "	500	do. " "
142	" "	do.	do.	H. Green & Co.	do.	" "	" "	" "	200	do. " "
143	" "	do.	do.	do.	do.	" "	" "	" "	600	do. " "
144	Sept. 3	J. Henderson	J. Henderson	Barnett & Co.	London	July 16	4 months	Nov. 19	1360	Barnett & Co., Nov. 19
145	" "	do.	do.	Davis & Co.	do.	" "	" "	" "	200	do. " "
146	" "	do.	do.	T. Gurney	do.	" "	" "	" "	200	do. " "
147	" "	do.	do.	J. Wilson	do.	" "	" "	" "	300	do. " "
148	" "	do.	do.	T. Carr	do.	" "	" "	" "	200	do. " "
149	" "	do.	do.	S. Curtis	do.	" "	" "	" "	200	do. " "
150	Oct. 5	W. Smith & Co.	W. Smith & Co.	J. Masterson & Co.	London	Oct. 30	4 months	Feb. 8	1300	J. Masterson & Co., Feb. 8
151	" 12	Schofield, Halse, & Co.	Schofield, Halse, & Co.	W. Bright	do.	" "	" "	" "	675	do. " "
152	" 16	For Tennant, & Co.	For Tennant, & Co.	J. Halifax	do.	" "	" "	" "	175	do. " "
153	" 18	T. Ellis & Sons	R. Heathfield	S. Catley	do.	" "	" "	" "	73	do. " "

DAY BOOK.

(1)

(1)

	Dr.			Cr.		
	£	s.	d.	£	s.	d.
1881, July 4th.						
Insurance Dr. to A. Lloyd				5	15	6
For premium on £175, on 7 hhd. Sugar, at £25 per hhd., from						
Berbice to London, at 3 per cent.	5	5	0			
Policy	0	10	6			
N. Herschell Dr. to Sundries				6	13	0
To Insurance (as above)	5	15	6			
To Commission (½ per cent. on Do.)	0	17	6			
8th.						
Insurance Dr. to A. Lloyd				19	6	9
For premium on £700, on 20 tierces Coffee, at £35 per tierce,						
from Berbice to London, at 2½ per cent.	17	10	0			
Policy	1	16	9			
J. Henderson Dr. to Sundries				22	16	9
To Insurance (as above)	19	6	9			
To Commission (½ per cent. on Do.)	3	10	0			
£	51	12	0	54	12	0
August 1st.						
Export Goods Dr. to Sundries				236	7	0
To S. Morley for 9 bales tow Osnaburgs						
To Tuelon & Co. for 3 cases of Hats	32	2	0			
3rd.						
Export Goods Dr. to Sundries				1016	11	3
To W. Phillips for Shoes	278	15	11			
To J. Parker for linen Tick	42	0	0			
To Matheson & Co. for Platillas	328	5	4			
To T. Barker for lint Osnaburgs	367	10	0			
Carried forward	1284	18	3	1284	18	3

(2)

DAY BOOK.

(2)

	Dr.			Cr.		
	£	s.	d.	£	s.	d.
August 5th.						
Brought forward	1284	18	3	1284	18	3
Insurance Dr. to A. Lloyd				33	18	9
For premium on £1500 on Sundry Goods from London to						
Jamaica, at 2 per cent.	30	0	0			
Policy	3	18	9			
7th.						
Schofield, Halse, & Co. Dr. to Sundries				1444	10	0
For amount of Invoice of Goods per the Dreadnought for						
Jamaica, as per Invoice Book, fol. 1:						
To Export Goods	1284	18	3			
To Charges (for Freight £38 10s. 6d., Duties and Fees £12 17s. 6d.)	51	8	0			
To Commission (5 per cent. on Goods and Charges)	66	15	0			
To Insurance (Premium on £1500 and Policy)	33	13	9			
To Commission (½ per cent. on Do.)	7	10	0			
10th.						
Export Goods Dr. to R. Hastie & Co.				60	0	0
For 60 barrels of Herrings at 20s. per barrel	60	0	0			
12th.						
Richard Sykes Dr. to Sundries				63	0	0
For Amount of Invoice of Herrings per the Fury for Barbadoes,						
as per Invoice Book, fol. 2:						
To Export Goods	60	0	0			
To Commission (5 per cent. on Do.)	3	0	0			
14th.						
Export Goods Dr. to J. Oswald & Co.				240	0	0
For 6 bales lint Osnaburgs	240	0	0			
16th.						
Export Goods Dr. to Sundries				1304	4	0
To Tuelon & Co., for 3 boxes of Hats	33	10	0			
To W. Phillips, for 6 trunks of Shoes	256	15	6			
To W. Silver and Co., for 1 cask of Nails	87	10	0			
To T. Barker, for 9 bales of tow Osnaburgs	250	16	6			
To W. Smith & Co. for 6 trunks of printed Muslins	675	12	0			
19th.						
Insurance Dr. to A. Lloyd				57	10	0
For Premium on £2550 on Plantation Stores, etc., from London						
to Jamaica, at 2 per cent.	51	0	0			
Policy	6	10	0			
Carried forward	4488	1	0	4488	1	0

LESSONS IN MUSIC.—XVIII.

ILLUSTRATIONS OF THE EFFECT OF TE AND RAY.

EXERCISE 30.—NARES' CHANT. KEY A. M. 72.

$\hat{m}$ $f : r$ $t_1 : -$ $\hat{d}$ $l_1 : f$ $m : r$ $d : -$
 A | soft · answer turneth away wrath, But | grievous · words stir · up an · · · ger.
 $\hat{d}$ $l_1 : f_1$ $s_1 : -$ $\hat{m}_1$ $f_1 : r_1$ $s_1 : s_1$ $d : -$

He that is | slow to · anger is || better · than th' | mighty,
 And he that | ruleth his · spirit than || he · that | taketh · a | city.

EXERCISE 31.—DELIGHTFUL SOUNDS. KEY D. M. 66.

s $d^1 : s$ $l : t$ $d^1 : t.l$ $s : f$ $m : s.f$ $m : r$ $d : -$ |
 Sweet to the morn · ing tra · vel · ler The song a · mid the sky, DA CAPO.
 Where twinkling in the dew · y light, The sky · lark soars on high.
 m $m : m$ $f : r$ $m : r.d$ $t_1 : r$ $d : m.r$ $d : t_1$ $d : -$ |

d^1 $t : d^1$ $r^1 : t$ $d^1 : r^1$ $m^1 : d^1$ $t : r^1.d^1$ $t : l$
 And when be · neath th'un · cloud · ed sun, Full wea · ri · ly toils
 m $r : m$ $f : r$ $m : s$ $d^1 : m$ $r : r$ $s : fe$

$s : -$ | $- : s$ $d^1 : s$ $l : t$ $d^1 : t.l$ $s : f$ $m : s.f$ $m : r$ $d : -$ |
 he, The flow · ing wa · ter makes to him A sooth · ing me · lo · dy.
 $s : -$ | $- : f$ $m : m$ $f : r$ $m : r.d$ $t_1 : r$ $d : m.r$ $d : t_1$ $d : -$ |

2. And when the evening light decays,
 And all is calm around,
 There is sweet music in his ear
 From distant sheep-bell's sound.

3. BUT OH! OF ALL DELIGHTFUL SOUNDS
 OF EVENING OR OF MORN,
 The sweetest is the voice of love
 That welcomes his return.

EXERCISE 32.—THE MERRY HOMES OF ENGLAND. KEY B FLAT. M. 80.

s_1 $s_1 : - : d$ $d : - : d$ $m : - : d$ $d : - : d$ $r : - : r$ $t_1 : - : t_1$
 The mer · ry homes of Eng · land, A · round their hearths · by
 What glad · some looks of house · hold love, Meet in the rud · dy
 m_1 $m_1 : - : m_1$ $m_1 : - : m_1$ $s_1 : - : m_1$ $m_1 : - : m_1$ $f_1 : - : f_1$ $s_1 : - : f_1$

$d : - : -$ | $- : - : d$ $r : - : r$ | $r : - : r$ $r : - : m$ | $f : m : r$
 night, DA CAPO. The hap · py homes of Eng · land, . . . The
 light.
 $m_1 : - : -$ | $- : - : m_1$ $f_1 : - : f_1$ | $f_1 : - : f_1$ $f_1 : - : m_1$ | $r_1 : m_1 : f_1$

$m : - : m$ | $m : - : m$ $m : - : f$ | $s : - : f$ $m : - : r$ | $d : - : d$
 HAP · PY HOMES · OF ENG · LAND, The hap · py homes of
 $s_1 : - : s_1$ | $s_1 : - : s_1$ $s_1 : - : f_1$ | $m_1 : - : l_1$ $s_1 : l_1$ | $t_1 : d : - : l_1$

$m : - : r$ | $d : - : d$ $r : - : r$ | $t_1 : - : t_1$ $d : - : -$ | $- : -$
 Eng · land, How beau · ti · ful they stand.
 $s_1 : - : f_1$ | $m_1 : - : l_1$ $f_1 : - : r_1$ | $s_1 : - : f_1$ $m_1 : - : -$ | $- : -$

2. There woman's voice flows forth in song,
 Or childish tale is told,
 Or lips move tunefully along
 Some glorious page of old.

3. The blessed homes of England,
 How softly on their bowers
 Is laid the holy quietness,
 That breathes from Sabbath hours.

4. The cottage homes of England,
 By thousands in her plains,
 Are smiling o'er the silvery brooks,
 And round the hamlet fanes.

5. Oh! green for ever be the groves,
 And bright the flow'ry soil,
 Where first the child's glad spirit loves
 His country and his God.

Another admirable illustration of the peculiar effect of RAY will be observed by the careful student in the above exercise. The "rousing" effect of this note, in the second strain, cannot fail to be noticed.

HISTORIC SKETCHES.—XXXII.

THE FALL OF JERUSALEM.

"O JERUSALEM, Jerusalem, thou that kist the prophets, and stonest them which are sent unto thee, how often would I have gathered thy children together, even as a hen gathereth her chickens under her wings, and ye would not! Behold, your house is left unto you desolate."

So said the Redeemer of the world as he sat upon the Mount of Olives, and looked down upon the city which was soon to be the scene of his mortal sufferings. The remarkable utterances he had made touching the Temple—that seemingly indestructible fortress, church, and treasury, which his disciples in common with other Jews regarded with something like superstitious reverence—had aroused the awful curiosity of his auditory, and they inquired of him privately when it should come to pass that "there shall not be left here one stone upon another that shall not be thrown down." The Lord's answer is well known, but cannot be too often repeated. Here it is purposely quoted in order to contrast the words of his prophecy with what actually came to pass. He warned his followers against the false Christs and false prophets that should arise, and then went on to describe

in exact terms what happened to the city of David at the hands of Titus. He told how that Jerusalem should be encompassed with armies; that the abomination of desolation spoken of by the prophet Daniel should stand in the holy place, "and where it ought not," and that "there will be great distress in the land, and wrath upon the people; and they shall fall by the edge of the sword, and shall be led captive into all nations. There shall be great tribulation, such as was not from the beginning of the world to this time, no, nor ever shall be; and Jerusalem shall be trodden down of the Gentiles, until the time of the Gentiles be fulfilled. This generation shall not pass away till all these things be done."

These words were spoken to the apostles with pain and grief. "On yet another occasion—the most awful possible—did the Lord announce, with like feelings of sympathy and distress, the "days of vengeance" which were coming upon the land. As he was led forth from Jerusalem to execution upon Calvary, a number of women followed, weeping. He turned to them, and said, "Daughters of Jerusalem, weep not for me, but weep

entire circuit of the city with a wall, so as to prevent the egress of the besieged, and to put a stop to all supplies reaching the city. Two out of the three lines of defence erected by the Jews were taken one after the other, with desperate slaughter on both sides; but the third wall, including the defences of the Temple, was held with wonderful resolution. Vain were the repeated attempts of Titus to bring the inhabitants to terms; they would not listen to any proposals, and the patriotism of the people was shown by the divided factions, which had hitherto weakened the national defences, combining to bring about a united defence, and by the unparalleled courage of the Jews, who devoted themselves in companies for the common weal. At length hunger—that most terrible of persuaders—began to tell upon them. A famine, unprecedented in the annals of war, aided the pestilence and the sword of the enemy. Several thousands died of hunger; there were not left people able to bury the dead; the most horrible cannibalism was practised—mothers eating their own children; and the sowers and dung-hills were resorted to for remnants of food which might yield some satisfaction to the miserable seekers after it. Deserters came into the Roman camp, only to be slain for the sake of the gold they were supposed to have swallowed; and prisoners taken with arms in their hands were crucified, or otherwise executed, save those who were sold into a slavery worse than that to which Nebuchadnezzar had subjected their forefathers. Gradually the last defences were assailed, and after a bloody contest carried, amid the despairing cries of the Jews and the triumphant shouts of the Romans. The Temple, well garrisoned, resisted last of all, and by its defence so exasperated were the Roman soldiers, that, in spite of positive orders from Titus to the contrary, they fired the gates, and even while the Roman commanders were in the Holy of Holies, which they were anxious to save, set the entire Temple ablaze in a great sheet of flame, which destroyed, besides the garrison, six thousand persons, including women and children, who had taken refuge in one of the courts. Fierce was the rage of the soldiery, ample was the opportunity for exhibiting it; and not all the exhortations, not all the threats of the officers could stop them in the work of destruction. For several days the work of death went on; neither age nor sex was spared; the nation, as represented by Jerusalem, was involved in one common destruction, and it was never known how many thousands perished after the city was actually taken. Ninety thousand persons were sold into slavery, and Josephus estimates the number of Jews who perished by famine, pestilence, and the sword, during the siege, at upwards of a million. The anger of the conquerors was not satisfied with the destruction of the people—the very stones of the city excited wrath. The Temple, which had been burnt with much of the treasure within it, was thrown down, not one stone being left upon another, and Roman soldiers drove a plough over the blood-stained ground which had been the site of the Holy of Holies. A few houses alone remained to show where had once been a city, and the captives who were saved were only so spared to grace the triumph of the Roman conquerors in Rome.

LESSONS IN GREEK.—XIX.

THE PRONOUNS.

PRONOUNS express the relation of an object to the speaker, inasmuch as they present either the speaker himself as the object (the first person), the person addressed (the second person), or the person spoken of (the third person); as I (first person), the teacher, give you (second person) the book (third person).

Pronouns may be divided into five classes—namely, the personal, the demonstrative, the relative, the indefinite, and the interrogative.

I. PERSONAL PRONOUNS.

1. The Substantive Personal Pronouns.

(i.) The simple, namely, *εγω* (Lat. *ego*), I; *συ* (Lat. *tu*), thou; *οὗ*, of himself.

Singular.

Nom. <i>εγω</i> , I;	<i>συ</i> , thou;
Gen. <i>μου</i> (εμου), of me;	<i>σου</i> , of thee; <i>οὗ</i> , of himself.
Dat. <i>μοι</i> (εμοι), to me;	<i>σοι</i> , to thee; <i>οἱ</i> , to himself.
Acc. <i>με</i> (εμε), me;	<i>σε</i> , thee; <i>ἐ</i> , himself.

N.A. <i>κα</i> , we (us) two;	<i>σὺ</i> , you two;
G.D. <i>ὑμεν</i> , of (to) us two;	<i>σφιν</i> , of (to) them you two;

Plural.

Nom. <i>ἡμεν</i> , we;	<i>ὑμεν</i> , you;	<i>σφεις</i> , n., σφεις, they.
Gen. <i>ἡμων</i> , of us;	<i>ὑμων</i> , of you;	<i>σφιν</i> , of them.
Dat. <i>ἡμιν</i> , to us;	<i>ὑμιν</i> , to you;	<i>σφισι</i> , to themselves.
Acc. <i>ἡμας</i> , us;	<i>ὑμας</i> , you;	<i>σφας</i> , n., σφεις, themselves.

Αὐτος, -η, -ο is sometimes given as the third person, yet it has the force of the English *he, she, it* only in the oblique cases; in the nominative it signifies not simply *he*, but *he himself*. In truth, the Greeks had no pronoun which exactly corresponds with our personal pronoun of the third person.

VOCABULARY.

Γράμμα, -ατος, το, a letter; pl., letters, that is, learning.	Διαφέρω (gen.), I differ from.	Συγχαίρω (dat.), I rejoice with (some one).
	Διαφθείρω, I corrupt, destroy.	

EXERCISE 62.—GREEK-ENGLISH.

1. Εγώ μεν γράφω, σὺ δε παίζεις. 2. Σεβόμαι σε, ὦ μέγα Ζεῦ. 3. Ὁ παῖς ἀκούει μου. 4. Ὁ πατήρ μοι φίλος ἐστίν. 5. Ὁ θεός αἰ σε βλέπει. 6. Εἰ με βλαπτεις, οὐκ ἐχθρὸν διαφέρεις. 7. Εἰς σου ἐρρωμενέστερος εἰμι. 8. Ἦδεως πεισθῆκαί σοι, ὦ πατήρ. 9. Ἦμεν ὅμιν συγχαίρομεν. 10. Ἡ λύρα ὕμιν ευφραίνει. 11. Ὁ θεός ἡμῖν πολλὰ ἀγαθὰ παρέχει. 12. Ὁ πατήρ ὕμιν στεργεῖ. 13. Ἀνδρείως μαχεσθε, ὡ στρατιῶται· ὅμιν γὰρ ἐστὶ τὴν πόλιν φυλάττειν· εἰ γὰρ ὕμεις φεύγετε, πᾶσα ἡ πόλις διαφθείρεται. 14. Ὑμῶν ἐστὶν, ὦ παῖδες, τὰ γράμματα σπουδαίως μανθάνειν. 15. Ἡ μήτηρ νῶ στεργεῖ. 16. Νῦν ἡν κακὴ νόσος. 17. Σὺ εἴχετε φίλον πιστότατον. 18. Σφιν δὲ πατήρ χαρίζεται· σφω γὰρ σπουδαίως τὰ γράμματα μανθάνετε. 19. Ὁ δέσποτα, ἀκούε μου.

The personal pronouns in the nominative are employed only, then, when a certain emphasis falls on them, especially in contrasts. In order to show in what instances they should be used in the following Exercises, the words where they are required are printed in italics.

EXERCISE 63.—ENGLISH-GREEK.

1. We write, but you play. 2. We two write, but you two play. 3. I honour you, O ye gods! 4. O boy, hear us! 5. God always sees you. 6. If thou injurest us, thou differest not from enemies. 7. You rejoice with us. 8. I willingly hear you, O parents. 9. Father loves thee and me. 10. Mother loves you both. 11. It is my duty (it is of me) to watch the house, for I am the guardian of the house. 12. It is thy duty, O boy, to learn earnestly. 13. The lyre affords pleasure to thee and me. 14. You two have (εἰς, with dat.) a very faithful friend.

ii. The reflective pronouns, *εμαυτον*, of myself; *σεαυτον*, of thyself; *ἐαυτον*, of himself.

Singular.

Gen. <i>εμαυτον</i> , -ης;	<i>σεαυτον</i> (σαντου), -ης;	<i>ἐαυτον</i> (αὐτου), -ης.
Dat. <i>εμαυτω</i> , -η;	<i>σεαυτῳ</i> (σαντῳ), -η;	<i>ἐαυτῳ</i> (αὐτῳ), -η.
Acc. <i>εμαυτον</i> , -ην;	<i>σεαυτον</i> (σαντον), -ην;	<i>ἐαυτον</i> (αὐτον), -ην, -ο.

Plural.

Gen. <i>ἡμων</i> αυτων;	<i>ὑμων</i> αυτων;	<i>ἐαυτων</i> οὐ αυτων, οὐ σφιν αυτων.
Dat. <i>ἡμιν</i> αυτοις, -αις;	<i>ὑμιν</i> αυτοις, -αις;	<i>ἐαυτοις</i> , -αις, οὐ αὐτοις, -αις, οὐ σφισιν αυτοις, -αις.
Acc. <i>ἡμας</i> αυτους, -ας;	<i>ὑμας</i> αυτους, -ας;	<i>ἐαυτους</i> , -ας, οὐ αὐτους, -ας, οὐ σφας αυτους, -ας, σφεις αυτους.

iii. The reciprocal pronouns.

While the reflective pronouns throw the act back on the subject, the reciprocals denote the interchange of the act, or the influence between two persons or two sets of persons: thus *ἀλλήλων* means of one another; *ἀλλήλοισι*, to one another; and *ἀλλήλους*, one another.

Plural.

Gen. <i>ἀλλήλων</i> ,	<i>ἀλλήλοισιν</i> , -αιν, -οισιν.
Dat. <i>ἀλλήλοισι</i> , -αις, -οις;	<i>ἀλλήλοισιν</i> , -αιν, -οισιν.
Acc. <i>ἀλλήλους</i> , -ας, -α.	<i>ἀλλήλους</i> , -ας, -α.

* * *

VOCABULARY.

Ἀφθονός, -ον, free from envy.	Μόνον, only.	Οὐρανίδαι, οἱ, the inhabitants of οὐρανός, heaven; that is, the gods.
Βλαβερός, -α, -ον, injurious.	Περίφερω, I carry round; hence our periphery.	Ὠφελίμος, -ον, useful.
Κακούργος, -ον (gen.), evil-doing; as a noun, an evil-doer.	Πλουτίζω, I enrich.	
	Οὐσία, -ας, ἡ, essence; property.	

EXERCISE 64.—GREEK-ENGLISH.

1. Ὁ βίος πολλὰ λυπηρὰ ἐν ἑαυτῷ (οὐ αὐτῷ) φερεῖ. 2. Γινώσκω σεαυτον (σαντον). 3. Βούλου ἀρεσκείν πασι, μὴ σεαυτῷ μόνον. 4. Ὁ σοφός ἐν ἑαυτῷ περιφέρει τὴν οὐσίαν. 5. Φίλων ἐπαίνον μάλλον ἢ σεαυτῷ λέγει. 6. Ἀρετὴ καθ' ἑαυτήν (per se, in itself) ἐστὶ καλὴ. 7. Οἱ πλεονεκταὶ ἑαυτοὺς μὲν πλουτίζουσιν, ἀλλοὺς δὲ βλαπτουσιν. 8. Οὐχ οἱ ἀκρατεῖς τοῖς μὲν ἀλλοῖς βλαβεροὶ, ἑαυτοῖς (οὐ σφισιν αυτοῖς) σὲ ὠφελίμοι εἰσιν, ἀλλὰ κακούργοι μὲν τῶν ἄλλων, ἑαυτῶν (οὐ σφιν αὐτῶν) ἐπὶ πολὺ κακούργοι. 9. Ἦμεν μὲν ἡμῖν αὐτοῖς ἡδίστα χαρίζομεθα. 10. Ἀφθονοὶ Οὐρανίδαι καὶ (οὐεν) ἐν ἀλλήλοισιν εἰσιν. 11. Οἱ κακοὶ ἀλλήλους βλαπτουσιν.

EXERCISE 65.—ENGLISH-GREEK.

1. The wise carry their (the) property about in themselves. 2. The avaricious man enriches himself, but injures others. 3. You gratify yourselves. 4. The intemperate is not hurtful to others, but useful to himself; but he is an evil-doer to others, and a much greater evil-doer to himself. 5. Good children love one another.

2. Adjective Personal Pronouns, or Possessive Pronouns.

Certain pronouns partake of the nature of an adjective as well as of a pronoun. For instance, *my*, in "my book," qualifies the noun *book*, and might, without serious error, be denominated an adjective; but since *my* also represents a noun, a noun of the first person, or the pronoun *I* which holds its place, *my* may also be termed a pronoun. *My*, consequently, is both an adjective and a pronoun, or an adjective pronoun; inasmuch, too, as *my*, *thy*, *his*, etc., signify possession, they may be also designated possessive pronouns. The possessive pronouns are—

Εμός, -η, -ον, my,	ἡμετερός, -α, -ον, our.
σός, -η, -ον, thy,	ὕμετερός, -α, -ον, your.
σφετερός, -α, -ον, theirs,	

Instead of *εμός*, the Attics employed the genitive *εμαυτου*, -ης, -ον, in a reflective meaning, and *αὐτου*, -ης, -ον, in the signification of the personal pronoun of the third person: for example, *τυπτεῖ τον ἑαυτου υἱον*, he strikes the son of himself, that is, he strikes his son, or his own son; you may also say *τυπτεῖ τον υἱον τον ἑαυτου*; also *τυπτεῖ αὐτον τον υἱον*, or again *τον υἱον αὐτου*.

The possessive pronoun is used in Greek only for the sake of emphasis. [When no contrast or other marked force is intended, the pronoun is omitted, and its place is supplied by the article, as *ἡ μήτηρ στεργεῖ τὴν θυγατέρα*, literally, the mother loves the daughter, that is, the mother loves her daughter. The person of the verb and the import of the proposition show what pronoun you should supply in English. Instead of the adjective personal pronoun *εμός*, *σός*, etc., the Greeks use with the same meaning the genitive of the substantive personal pronoun, as *εμου*, *σου*, also *εμαυτον*, etc.]

VOCABULARY.

Μεθηνών, -ον, neglectful.
Μεταχειρίζομαι, I handle, conduct, govern.

EXERCISE 66.—GREEK-ENGLISH.

1. Ὁ ἐμός πατήρ ἀγαθός ἐστιν· οὐ δὲ πατήρ μου ἀγαθός ἐστιν ὁ ἀγαθός ἐστὶ μου ὁ πατήρ. 2. Παντες στεργουσιν τοὺς σφετερούς πατέρας· οὐ τοὺς ἑαυτων πατέρας· οὐ τοὺς πατέρας· τοὺς ἑαυτων. 3. Οἱ ὕμετεροι παῖδες σπουδαίως τὰ γράμματα μανθάνουσιν. 4. Οἱ παῖδες ὅμιν καλοὶ εἰσιν. 5. Ὑμῶν οἱ παῖδες σπουδαίως εἰσιν. 6. Τα ἡμων αυτων τεκνα· οὐ τα τεκνα τα ἡμων αυτων ψεγομεν. 7. Ὁ φίλος σου πιστός ἐστιν. 8. Ὁ φίλος μου ἀπίστος ἐστιν. 9. Ὁ σὺς νεὺς το σὺν σῶμα μεταχειρίζεται. 10. Ὁ μὲν ἐμός παῖς σπουδαίως ἐστίν, ὁ δὲ σὺς μεθηνών.

EXERCISE 67.—ENGLISH-GREEK.

1. Thy father is good. 2. My father is good. 3. Our father is good. 4. Their slaves are bad. 5. Our children learn diligently, but your children are neglectful. 6. Thy friend admires his own deeds, but not those of others.

KEY TO EXERCISES IN LESSONS IN GREEK.—XVIII.

EXERCISES FROM THE CLASSICS.—GREEK-ENGLISH.

1. Every hard thing is with difficulty softened. 2. Heaven is brazen externally. 3. Bion used to say that he was unfortunate that did not bear misfortune. 4. Philosophy teaches that we ought to be very joyful in prosperity, and not to be greatly excited and like wild beasts in our passions. 5. How can men who are either thankless, or careless, or avaricious, or treacherous, or incontinent, become our friends? 6. Wealth and external gifts are profitless to those who have them without virtue. 7. What bird is sweeter than the nightingale? 8. Second thoughts are somehow wiser. 9. Darius and Parysatis have two sons; the elder is Artaxerxes, and the younger is Cyrus. 10. Women are more given to mourning than men. 11. To do injustice is worse than to suffer injustice. 12. Agesilaus used to say concerning the great king, In what respect is he greater than I am, unless he is more just? 13. Zeno seeing Theophrastus wondering at his having so many disciples. The band of that one is greater, said he, but mine is more harmonious. 14. Sophocles was wise, Euripides was wiser, but Socrates was the wisest of all men. 15. The bee by nature finds out the smoothest and most useful honey. 16. All men perform things they know very easily, swiftly, beautifully, and pleasantly. 17. Do each thing well and manfully. 18. O Astyages, he said, you have acted nobly in speaking first. 19. They punish those who are caught as bad thieves. 20. It is uncertain whether it will be better or worse. 21. How can he honour the gods better or more piously? 22. Socrates seeing a little boy rich and uneducated, Lo, said he, a golden slave!

EXERCISE 61.—ENGLISH-GREEK.

1. Οἱ σοφοὶ οὐ ζητοῦσι τὰ ἐξω. 2. Γυναῖκες πασχουσιν μάλιστα ἐν ταῖς διαπραγμασίαις. 3. Ὁ ἀκράτης οὐ δύναται γιγνεσθαι πιστός φίλος. 4. Ἀνδρῶν ἐστὶν ἡλιθιότης τῶν ἐρῶντων. 5. Κοραὶ ἐστὶ μείζων λυπηὴ τῶν γυναικῶν. 6. Ὁ σοφώτατος ἐστὶ μέγιστος. 7. Θανατοῦμαι ἐπὶ τῇ ἐχρῖν πολλὰ χρημάτων. 8. Πῶς ἀνδρὲς θανατοῦμαι ἐπὶ τῇ ἐχρῖν πολλὰ χρημάτων. 9. Ἀδελφός ἐμὸς ἐστὶ σοφός, ὁ πατήρ σοφέτερος, ὁ φίλος σοφώτατος. 10. Τα τεκνα φυσικῶς φιλοῦσι τοὺς τοκεάς. 11. Μαχεσθε, ὦ πολῖται, ἐν τῇ καὶ ἀνδρείως περὶ τῆς πόλεως.

RECREATIVE NATURAL HISTORY.

THE LOBSTER AND CRAYFISH.

NEARLY everybody has seen a lobster, either dead or alive. People living inland may be only acquainted with the red specimens one sees lying on the fishmonger's slab, but dwellers on the sea coast know something about the live animal, which is of a dark-blue colour. For many reasons it is an extremely interesting creature, and for years has been chosen as an excellent subject for dissection by students of biology, on account of the lessons that may be learnt from it concerning the structure of the class of animals to which it belongs. These matters, however, are elsewhere discussed, and it will be sufficient for our present purpose to learn a few of the more prominent facts concerning it. First, then, it is worthy of note that the lobster has no internal skeleton, but is provided with a hard external covering in many pieces which answers the same end, forming an outside skeleton. What seems to be the largest part of this outside skeleton is that which covers the head and thorax. Then comes the other portion of the body, in six parts or segments, ending with the tail or telson. These abdominal segments are every one formed on the same plan, each carrying a pair of swimmerets. On the last or sixth segment the swimmerets are more wonderfully developed than those belonging to any of the other segments. Besides these swimmerets there are four many-jointed legs on each side of the thorax, which are known as ambulatory legs, and two large claws or chela. The most notable of the appendages of the head are the eye-stalks, the very long antennae, which are about the length of the whole body, and the four lesser slender appendages in between, which are known as antennules.

If we were to remove the top portion of its hard covering from the head to the tail, we should come to the various organs necessary for lobster life. Under the large piece of shell we have before mentioned we should observe the stomach, liver, and heart, and on each side, separated from these organs by a partition, there would be visible the gills, or breathing apparatus, which are attached to the ends of the ambulatory legs and claws. Various arteries would be seen carrying colourless blood, and the alimentary canal leading from the stomach might be traced to its termination on the under surface of the telson. And upon removing all these parts the nervous system would be seen quite at the bottom, consisting of little knots of white nervous matter at regular intervals.

connected to each other, and with nerve filaments passing from the knots to their appointed places in the lobster's body. So much might be seen by a rough examination of the lobster's internal economy. Perhaps the prettiest thing in the whole body is what is known as the gastric mill within its stomach, a curious mechanical arrangement designed apparently to pound up its food: The main parts of this crushing apparatus are three teeth—two of them parallel to one another, and the third occupying an intermediate position. By putting certain parts of the opened stomach together it is perfectly easy to see the way in which these teeth are employed to crush material that may be passed into the stomach. A remarkable feature about these teeth, and one giving them considerable beauty, is their colour. Of a yellowish brown on their crushing surfaces, they gradually become of a delicate bluish green towards the base. The external colour of animals is usually supposed by naturalists to subserve some useful end, but it is hard to see what may be the utility of the hidden colouring of a lobster's gastric mill.

The common lobster (*Homarus vulgaris*) is a familiar enough object around our coasts. It lives at the bottom of the water, crawling over the bed of sand and rock, ever ready for any prey that accident may bring in its way.

There is a great demand for lobsters as an article of food, to supply which the fishermen lower wickerwork baskets down into the water, marking their position by means of buoys. The lobsters creep into these "pots," as they are technically termed, in search of the garbage with which they are baited, and being unable to get out are captured when the pots are hauled up. Perhaps no approximate estimate could be given of the millions thus captured every year for the use of man; and the destruction among these crustaceans is further increased by the fact that the female lobsters have usually a vast number of eggs under their bodies in a more or less advanced stage of development, more than twelve thousand eggs having been counted under the body of one female lobster.

When these little eggs first appear they are extremely small and black. They afterwards attain nearly to the size of ripe elder-berries, and turn of a dark-brown colour. At the time of laying the eggs the female bends up her body, and the eggs thus become attached to a sticky substance which covers the hairs of the abdominal appendages. They are thus carried about until they become hatched. It must, however, be only a small percentage of these eggs which produce young lobsters, as it would appear that, although the eggs are laid at all times of the year, it is only in the warm months of July and August that they are hatched. This looks very much like waste in nature, but the unhatched eggs may subserve some useful purpose unknown to us.

There is a marked inconvenience attending the possession of an outside skeleton, enclosing the animal as if in a rigid box. The lobster must grow, and accordingly it periodically casts off its hard coat. According to some authors this moulting appears to be rather a trying operation; for when the animal is going to cast off its old suit, it retires from the open parts of the sea, and seeks out some retired place among the rocks where there will be the least chance of interference on the part of any enemies that may be roaming about. Its activity ceases, and it is no longer voracious or quarrelsome, but quietly awaits the favourable moment for effecting the change. When that moment has arrived, it throws itself upon its back, every limb seems to tremble, and the whole body is in violent motion, while it swells itself in an unusual manner. At last the shell begins to divide and is cast off, along with the covering of the eyes, the lining membrane of the stomach, and the teeth connected with it. Even the casings of the legs and claws are cast off as if they had only been top boots. A state of exhaustion follows, during which the defenceless lobster lies

motionless and helpless, a prey to every marine animal that considers lobster palatable. In the meantime, however, a rapid process of restitution is going on; for in about a couple of days a new shell has been formed, and the animal has then obtained a new suit. The number of its moultings per year depends on its age, there being as many as six moults in the first and second years of its life, four in the third year, and three in the fourth year.

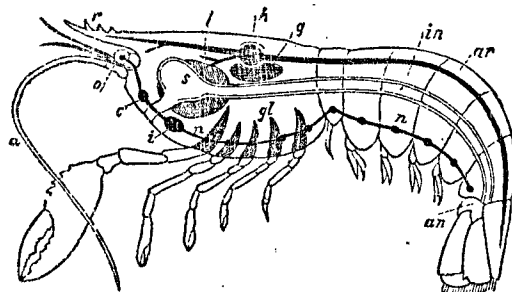
In the information given thus far it will be perceived that there is quite a community of facts respecting the crab, described in a former article, and the lobster. Both are animals enclosed in outside skeletons of calcareous matter which they periodically cast off; both have ambulatory legs and large claws; each is turned from its natural colour when boiled in water to the red so well known to inland dwellers, many of whom erroneously regard the red colour of a boiled lobster as its natural colour—a belief which has probably given rise to the well-known expression, "As red as a lobster." But while there is much in common between the lobster and the crab, there are many differences, which will be at once perceived upon comparing the two animals side by side and part for part. The divergence is much more wide than that which exists between the lobster and the crayfish (*Astacus fluviatilis*). All three animals are sufficiently alike to be included in the same order, but the lobster and crayfish are really so much alike that the same name *astakos*, the Greek for lobster, was applied to both until Milne-Edwards suggested an alteration of names, as the two animals were sufficiently different to warrant it. The name the lobster then received was *Homarus vulgaris*, and the crayfish retained its old appellation of *Astacus fluviatilis*, which means river lobster.

The crayfish (*Astacus fluviatilis*) is a tiny little animal, seldom exceeding four inches in length. It is a sort of miniature lobster, as a close examination of it externally and internally will prove. Such an examination would lead to the discovery of certain differences between their gills and abdominal appendages, &c., but generally they are so much alike that one can understand naturalists half a century ago calling them both lobsters, giving the name of "marine lobster" to the *Homarus*, and "river lobster" to the crayfish.

There is a great demand for the crayfish as an article of food in France, where they are caught in a variety of ways. The young crayfish is formed within the egg much in the same fashion as a chick is formed within the hen's egg; and when it is hatched, the tiny crayfish presents a general resemblance to its parents. It is not so in the case of the crab and lobster; for here the young, when hatched, have to go through certain changes before they attain to the mature form.

Lobsters and crayfish can both see and hear, and are furnished with peculiar organs for these purposes. The auditory organs are lodged in the basal joint of the antennules. Here in each antennule there is a bag containing clear liquid, and projecting into this fluid from certain sides of the bag there are a vast number of minute hairs, which are in communication with delicate nerve filaments. When a sound is produced, the sonorous vibrations travelling through the water affect the liquid contents of the bag, agitate the minute hairs, and consequently the nerve filaments, thus giving rise to the sensation of sound.

The eye, both in lobster and crayfish, is entirely unlike the eye of a back-boned animal. The free extremity of the eye-stalk presents a soft, transparent, and convex surface, which is divided into minute squares or facets by faint lines. It is one of those compound eyes so often met with in other crustacea and in insects. Each of these facets forms a base for what is called a *visual pyramid*, and within each of these pyramids there are the elements required for seeing, which are probably in connection with the optic nerve. It is a matter of dispute how a crayfish sees with such eyes, but that it does so is certain.



LONGITUDINAL SECTION OF LOBSTER.

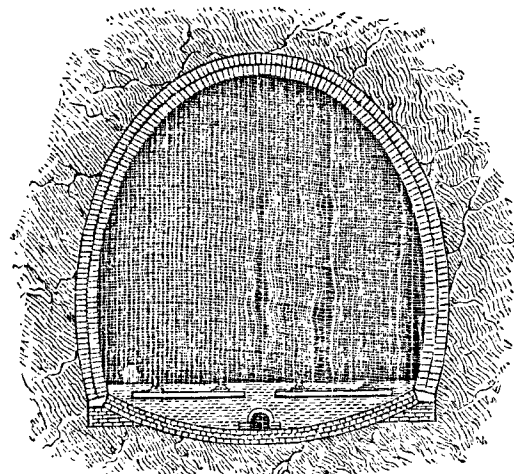
a, antenna; r, rostrum; o, eye; s, stomach; in, intestine; h, heart; l, liver; n, nervous ganglia; g, gills; c, chief nervous masses; ar, a main blood-vessel.

LESSONS IN ARCHITECTURE.—XV.

RAILWAY ARCHITECTURE.—I.

THE progress of railways has given rise to vast strides in practical engineering, and been attended by the development of a kind of architecture entirely novel in its character. The wonderful bridges, the huge stations, and the many ingenious contrivances of a less imposing but not less useful nature, which are connected with the modern railway system, will afford us a profitable subject of study in the next of our Lessons.

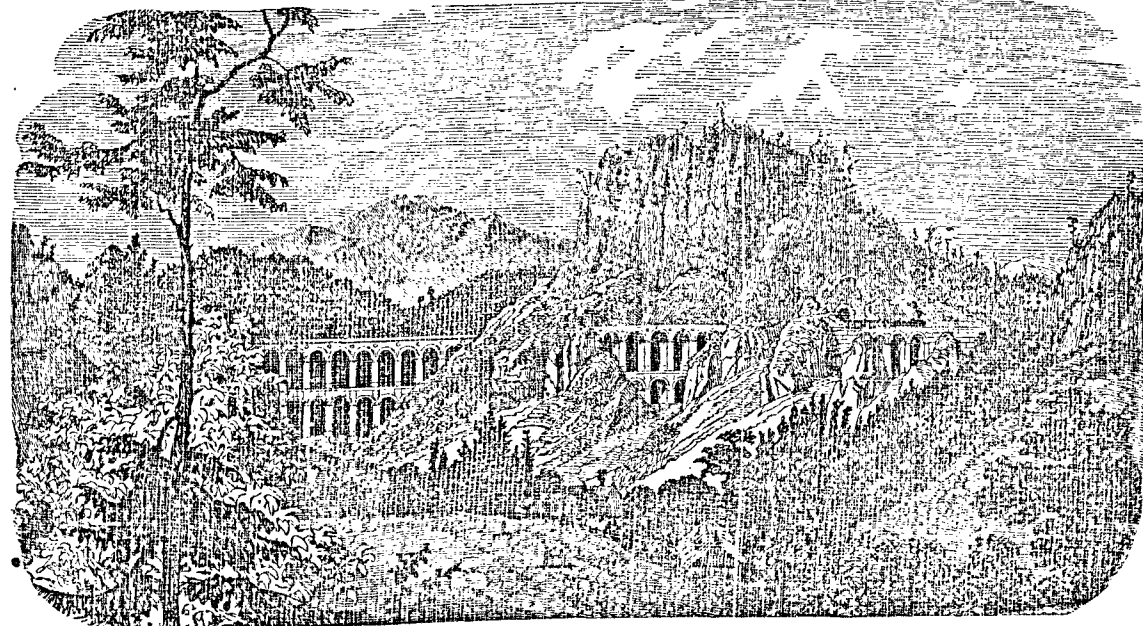
Let us first trace the process of construction of a railway line. Before the works can be commenced, the country has to be thoroughly surveyed, its principal features noted with minute accuracy, and the course of the line finally determined upon, with due regard, not only to readiness of transit from point to point, but also to the avoiding of physical obstacles where practicable, or overcoming them by engineering skill. A line is frequently taken many miles out of the straight course to avoid the necessity of the construction of lengthy tunnels through hills, of viaducts over precipitous valleys, or bridges over important streams. Where the country is comparatively level, the engineer's task is easy, and he can go straight onwards; and where it departs but little from a certain general elevation, the minor obstacles it presents are readily surmounted, either by alteration of the gradient or incline of the line, or by cuttings or embankments, as the ground happens to be too high or too low.



SECTION OF A RAILWAY TUNNEL.

the most eminent engineers were divided in opinion as to what the gauge—or width between rail and rail of a single line—should be. Some contended for a broad, and others for a narrow gauge, as most desirable; and the long discussion which took place on this subject is known as the "battle of the gauges." At the head of the broad-gauge party was Isambard Brunel, who contended for a width of 7 feet from the inside of one rail

to that of the other; and he constructed the Great Western Railway on this principle. In the front rank of his opponents was Robert Stephenson, who maintained the opinion of his father, George Stephenson—the founder of our railway system—that 4 feet 8½ inches was the most suitable width; and the Stephensons carried out their opinion in the series of railways now known as the London and North-Western. But the inconvenience of different gauges throughout the country threatened to become so serious as railway construction extended, that Parliament stepped in and enacted, in 1846, that the narrow-gauge of 4 feet 8½ inches should thenceforth be adopted in all railways laid down in England and Scotland. By this means facility of communication, in the passage of the same carriages from one line to another, was secured; and the Great Western afterwards brought itself into communication with the narrow-gauge lines, by placing a third rail within the original two at those points where access to or from its own line was required, and continuing this third rail as far as it might be necessary to run the carriages of other lines on their system. The width of the gauge varies in different countries.



VIADUCT ON THE VIENNA AND TRIESTE RAILWAY.

The course having been determined on, it is marked throughout at the width required either for a single or a double line of rails, and the removal of the surface earth commences, in readiness for the laying of the permanent way. The width of a line is now regulated in this country by the enforced adoption of a uniform gauge. When railway construction first commenced,

In Ireland it is 5 feet 3 inches; in India it has been fixed at 5 feet 6 inches.

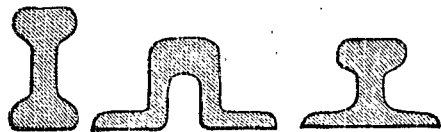
The chief reasons for the final adoption of the narrow gauge were the greater economy in construction—less land being necessarily required—and the saving of wear and tear by the employment of smaller and more economical "rolling-stock," &c.

the engines and carriages. The precise width of the narrow-gauge approved by Parliament for this country was determined by its having been already largely used by the Stephensons in the important lines constructed under their superintendence.

Supposing a double line of railway to be required, a space of 6 feet—known as the "six-foot way"—is usually left between the two lines, making a total of 16 feet, including the thickness of the rails. The space left on the outer sides of the rails is determined by circumstances, but the entire width of a double line is usually between 28 and 37 feet. Beyond this width a space is left on either side for the drainage of the line.

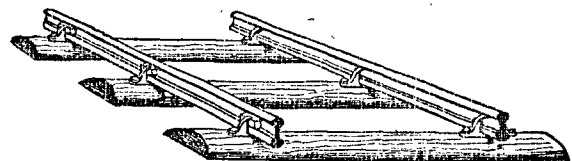
The excavators having cleared away the surface earth, the ballast is next laid down along the line, to form a solid roadway. The ballast consists of gravel, cinders, burnt clay, broken bricks, or whatever material of a similar character may be most readily procured. It is generally laid 2 feet in depth, 1 foot or more being under the sleepers, and the rest around and above them. The sleepers are blocks of sound, seasoned wood, laid across the roadway at distances of about a yard apart, to form a foundation and resting-place for the iron rails. The sleepers are frequently formed of larch trees cut in halves, and laid with the flat sides downward. Iron sleepers have occasionally been employed, but their use at present is rare.

The rails are of wrought iron, usually weighing from 70 to 80 pounds to the yard, and varying in shape in different lines and countries. We give an illustration of the transverse sections of some of the rails in most general use. The first is the rail com-



SIDE SECTION OF IRON RAILS.

monly used on English lines; the second is employed in bridges, and on the Great Western Railway; the third is largely used in America. They are made in short lengths, carefully fastened together by "fish-plates" at the sides, and are set in cast-iron chairs. These chairs are affixed to the sleepers by means of trenails, and when the rails are laid in the chairs, wedges of compressed wood are employed to tighten them up in their position; and the space between rail and rail is carefully adjusted all along the line by means of a measuring gauge. The annexed cut will show the relative positions of sleepers, chairs, and rails.



RAILWAY SLEEPERS, CHAIRS, ETC.

These particulars will be sufficient to enable our readers to understand the ordinary process of making a level line of railway. Even on a continuous level, however, great impediments have occasionally to be encountered, from the varying character of the soil, and the occasional difficulty of providing a secure foundation for the line. We may mention as a notable instance that which was successfully contended with by George Stephenson, in throwing his line for the Manchester and Liverpool Railway over the Lancashire bog known as Chat Moss. The ground here was so soft in many places that a man stepping on it would sink in, and even, in some parts, a piece of iron thrown upon it would sink by its own weight; and it was thought by many persons that it would be impossible to throw a line of railway across it, much less to make it safe and durable for traffic. The great engineer succeeded, by throwing huge fagots or hurdles across the treacherous earth, until he had secured a tolerably firm basis for his operations; and then, partly by drainage, and partly by piling on more and more fagots, he at last made a sound and substantial roadway.

Where a line of country departs from the level, it becomes necessary that the roadway should be raised in some places and

lowered in others. This is done, when the change of level is slight, by means of cuttings and embankments; but when considerable, tunnels, viaducts, and bridges must be constructed.

Cuttings are excavations which form a small valley wherein the line may run. Wherever it is necessary to carry the railway below the surface of the ground, and the depth at which it must run does not amount to more than from 50 to 60 feet, a cutting is the means employed to effect the purpose. For a greater depth than 60 feet it is usual to make a tunnel, unless the line runs through solid rock or chalk, as in the case in many parts of the London and Brighton Railway, where much deeper cuttings may be employed with safety, and the sides may be left almost perpendicular. Otherwise, cuttings are made with sloping sides, which must be carefully formed, so that the earth does not slip in from above. Some soils are very treacherous, and the vibration produced by the passage of trains, added to the disintegrating influence of weather, would soon bring the upper earth down into the cutting, if the sides were not sloped at a sufficient angle, and well secured. The drainage of cuttings also requires attentive consideration.

Embankments carry the line above the surface of the country by an artificial roadway. They are built of earth, much broader at the base than at top, to afford a secure foundation. But care must be exercised to guard against the possibility of any giving way of the soil below, for serious accidents have occasionally been caused on embankments by the sinking of the lower strata, although the engineer's work near and above the surface may have been perfectly sound.

The slopes of embankments generally have a width of 1½ feet horizontal to 1 foot perpendicular; but this depends partly on the material of which they are composed. Every kind of material has an angle of its own—called "the angle of repose"—at which it will remain most steady, and this has to be studied in the formation of embankments and cuttings. The sides of both are more durable when protected by turf, which is generally laid or sown for this reason.

As before remarked, where the inequality of the ground is so great that cuttings and embankments would be impracticable, the engineers have to resort to tunnels and viaducts. Probably every one who will read these pages has had practical experience of the nature of a tunnel, but the labour and the skill involved in constructing one may not be generally known. In the first place, the earth or rock has to be picked out inch by inch, and foot by foot, from the hill or mountain, and close observation is required to ensure that the underground workers will go without deviation to the point which has to be reached on the other side. Where the tunnel is of great length, two parties commence the excavation from opposite ends, meeting in the centre. As the hollow is formed, and the earth removed, the tunnel has to be arched over and under with double brickwork, and culverts must be placed under the roadway to ensure effectual drainage. But before all this can be done, difficulties, and even dangers, must frequently be met. Sometimes they arise from the friable nature of the material through which the tunnel must be excavated, causing a frequent falling in upon the works. Sometimes they are met in the form of an immense quantity of water which percolates through the hill-side, or is found in the strata of which the hill is partly composed. As an instance, we may mention that in the construction of the Kilsby tunnel, on the London and North-Western line, the quantity of water tapped in its progress was so great that it was the work of eight months to exhaust it, although the pumping out proceeded at the rate of many hundreds of gallons per minute.

The section of an ordinary tunnel in which two lines are laid will best show the kind of work of which such a structure is composed. It will be found on the previous page.

While precipitous hills are penetrated by tunnels, corresponding declivities are arched over by viaducts or bridges. Viaducts are usually formed of brick or stone arches on which the railway rests; and sometimes, where a deep valley has to be spanned over, these arches rest tier above tier, forming a double length. A fine example of such a viaduct, and of the kind of country these erections are constructed to traverse, is given in our illustration, which represents the viaduct of Rigolo Froide, on the Semmering Railway, which unites Vienna to Trieste.

Railway bridges over rivers and streams are now most frequently constructed of iron; and these, in their various forms, will engage our attention in another paper.

READINGS IN GERMAN.—VIII.

9.—Die vier Jahreszeiten.
Der feier yah'-ress-tsi'-ten.

Ich wenn's doch immer Winter bliebe! sagte Ernst, als ich venuss döch im'-mer vin'-ter bleo'-bai! zah'-tai Ernst, aiss er einen Mann von Schnee gemacht hatte, und im Schlitten eyr i'-nen man kön shney gai-macht hat-tai, dönt im shliit'-ten gefahren war.
gai-fah'-ren vahr.

Sein Vater sagte, er möchte diesen Wunsch in seine Zine fah'-ter zah'-tai, eyr möy'-tai döt'-zen vössh in zi'-nai Schreiftafel schreiben, und er that es.
shripe'-tah'-fel shri'-ben, dönt eyr taht ess.

Der Winter verging, es kam der Frühling. Ernst stand dair vin'-ter ferr-ghink, ess kahm dair frü'-link. Ernst stant mit seinem Vater bei einem Blumenbeete, auf welchem mit zi'-nem fah'-ter by i'-nem bloo'-men-bey'-tai, auf vel'-yem Spacinten, Purifeln und Narissen Küheten, und war hee-a-tsin'-ten, ou-ree'-keln dönt nart-teiss'-sen blu'-hai'-ten, dönt vahr vor Freuten ganz außer sich.
fore froi'-den gants ou'-sser zly.

Das ist eine Freude des Frühlings, sagte sein Vater; zie Dass ist i'-nai froi'-dai dess frü'-links, zah'-tai zine frü'-ter; zie wird bald wieder vergehen.
virtt balt vee'-der ferr-ghoy'-hen.

Ich, antwortete Ernst, wenn's doch immer Frühling wäre. Ich, ant'-vör-tai-tai Ernst, venuss döch im'-mer frü'-link vey'-rai.
Schreib diesen Wunsch in meine Schreiftafel, sagte sein Shripe döt'-zen vössh in mi'-nai shripe'-tah'-fel, zah'-tai zine Vater, und er that es.
fah'-ter, dönt eyr taht ess.

Der Frühling verging, es kam der Sommer. Ernst ging dair frü'-link ferr-ghink, ess kahm dair zöm'-mer. Ernst ghink mit seinen Eltern und einigen Gespielen an einem warmen mit zi'-nen el'-tern dönt i'-n-ghen gai-shpee'-len an i'-nem varr'-men Sommertage nach dem nächsten Dorfe, und sie blieben zöm'-mer-tah'-gai nahch daim neyy'-sten döt'-fai, dönt zee bleo'-ben tafelfest den ganzen Tag. Rund um sich her sahen sie da-zelpst dain gan'-tsen tahch. Rönt döm zly heyr zah'-hen zee grüne Ganten und Wiesen, mit tausentfältigen Blumen grü'-nai zah'-ten dönt vee'-zen, mit tow'-zent-fel-ti'-ghen bloo'-men geschmückt, und Auen, auf welchen junge Sämmen tanzen gai-shmückt, dönt ou'-en, auf vel'-yem yössh-ai lem'-me. tanta'-ten und muschwillige Füllen ihre Sprünge machten.
dönt moot'-vil-li-gai ful'-len ee'-rai shprung'-ai mach'-ten.

Sie sahen Kirichen und anderes Sommerobst, und Zoo ah'-ssen kurr'-shen dönt an'-dai-ress zöm'-mer-o'-pst, dönt ließen sich den ganzen Tag über recht wohl sein.
lee'-ssen zly'ss dain gan'-tsen tahch a'-ber rey't vole zine.

Nicht wahr, fragte der Vater beim Zurückgehen, der Niyt vahr, frach'-tai dair fah'-ter bime tsoo'-rück'-ghe'-hen, dair Sommer hat doch auch seine Freuden?
zöm'-mer hat döch auch zi'-nai froi'-den?

O, antwortete Ernst, ich möchte, daß es immer Sommer wäre! Er mußte auch dieses in die Schreiftafel seines Vaters schreiben.
Oh, ant'-vör-tai-tai Ernst, iy vö'-tai, dass ess im'-mer zöm'-mer wäre! Ey'r müsst auch dieses in die shripe'-tah'-fel zi'-ness fah'-ter'ss shri'-ben.

Endlich kam der Herbst. Die ganze Familie brachte Ent-ly kahm dair herrpst. Der gan'-tsai fa-mee'-li-ai brach'-tai einige Tage in einem Weinberge zu. Es war nicht mehr i'-n-gai tah'-gai in i'-nem vine-berr-gai tsoo. Ess vahr niyt meyr so heiß als im Sommer, aber die Luft war sanft und der so hies als im zöm'-mer, ah'-ber dee löst vahr zant dönt dair Himmel heiter. Die Weinblätter waren mit reifen Trauben him-mel hi'-ter. Der vine-stöck-kai val'-ren mit ri'-fen trou'-ben behangen; auf den Wäldern sah man wohlgeschmückte ba-hang'-en; auf dain mist'-bey'-ten zah man vole-shmeck'-ken-dai

Melonen liegen, und die Zweige der Bäume wurden von mai-lo'-nen lee'-ghen, dönt dee tsvi'-gai dair boi'-mai vöör'-den kön reifen Früchten niedergezogen. Das war erst ein richtiges ri'-ien früy'-ten noe'-der-gai-tso'-ghen. Dass vahr eyrst ine rey'-tees fest für unsern Ernst, der nichts lieber als als Obst. Die schöne Zeit, sagte sein Vater, wird bald vorüber sein, der sho'-nai tsite, zah'-tai zine fah'-ter, virtt balt fore-a'-ber zine, dair Winter ist schon vor der Thür, um den Herbst zu vertreiben.
vin'-ter ist sho'-ne fore dair tü'r, döm dain herrpst tsoo ferr-tri'-ben.

Ich, sagte Ernst, ich möchte, daß er wegbliebe, und daß ich, zah'-tai Ernst, iy vö'-tai, dass eyr vey'-blee-bai, dönt dass es immer Herbst wäre.
ess im'-mer herrpst vey'-rai.

Wolltest du das wirklich? fragte sein Vater. Wirklich, Völ-test doo dass wirklich? frach'-tai zine fah'-ter. Wirk'-ly, war seine Antwort. Aber, fuhr sein Vater fort, indem er vahr zi'-nai ant'-vört. Ah'-ber, foor zine fah'-ter fört, in-deym eyr die Schreiftafel aus der Tasche zog, sieh doch einmal, des shripe'-tah'-fel ouss dair tash'-shai tso'-ch, zee döch ine-mahl, was hier geschrieben steht; lies doch.
vass here gai-shree'-ben shteyt; lees döch.

Ich wollte, daß es immer Winter wäre. Ich, iy vö'-tai, dass ess im'-mer vin'-ter vey'-rai.
Und nun lies einmal hier auf dieser Seite, was steht dönt noon lees ine-mahl' here auf dee'-zer zi'-tai, vass shteyt denn da?
den dah?

Ich wollte, daß es immer Frühling wäre. Ich, iy vö'-tai, dass ess im'-mer frü'-link vey'-rai.
Und was auf dieser Seite hier? dönt vass auf dee'-zer zi'-tai here?
Ich wollte, daß es immer Sommer wäre. Ich, iy vö'-tai, dass ess im'-mer zöm'-mer vey'-rai.
Kennst du, fuhr er fort, die Hand, die dieses geschrieben Kenst doo, foor eyr fört, dee hant, dee dee'-zess gai-shree'-ben hat?
hat?

Das habe ich geschrieben, antwortete Ernst. Dass hab'-hai iy gai-shree'-ben, ant'-vör-tai-tai Ernst.
Vater. Und was möchtest du jetzt eben? Fah'-ter. Dönt vass vössh-test doo yetst ey'-ben?
Ernst. Ich wünschte, daß es immer Herbst sein möchte. Ernst. Iy vössh'-tai, dass ess im'-mer herrpst zine möy'-tai.
Das ist doch sonderbar genug, sagte der Vater. Im Dass ist döch zom'-der-bahr gai-noo'-ch, zah'-tai dair fah'-ter. Im

Winter möchtest du, daß es Winter, im Frühling, daß es vin'-ter vössh-test doo, dass ess vin'-ter, im frü'-link, dass ess Frühling, im Sommer, daß es Sommer, und im Herbst, daß es frü'-link, im zöm'-mer, dass ess zöm'-mer, dönt im herrpst, dass cas Herbst bleiben möchte. Denk einmal nach, was folgt wohl herrpst bli'-ben möy'-tai. Denk ine-mahl' nahch, vass fölyt vole daraus?
da-rouss?

Ernst. Daß alle Jahreszeiten gut sind. Ernst. Dass al'-lai yah'-ress-tsi'-ten goo't zint.
Vater. Ja, daß sie alle reich an Früchten, reich an man-fah'-ter. Yah, dass zee al'-lai ri'-y an froi'-den, ri'-y an man'-nigfaltigen Gaben sind, und daß der liebe große Gott nly-fal-ti'-ghen gai'-ben zint, dönt dass dair lee'-bai gro'-esai göt viel besser seine Welt eingerichtet hat, als wir armen feel bess'-ser zi'-mai velt ine'-gai-ri'-y-tet hat, als vee'r arr'-men Menschen versehen.
men'-shen ferr-shteyt'-hen.

VOCABULARY.

Jahreszeit, f. season. Ich, oh, alas. Schlitten, m. sledge.
(Zahr, n. year; Zeit, Wenn's, contraction, Gr möchte, that he
f. time.) if it. should.

Wunsch, <i>m.</i> wish, desire	Sprung, <i>m.</i> spring, gambol.	Erst, <i>first</i> , only, no till now.
Schreibtafel, <i>f.</i> pocket book, tablet.	Kirsche, <i>f.</i> cherry.	Fest, <i>n.</i> feast, festival.
(Schreiben, to write.)	Obst, <i>n.</i> fruit.	Richter, <i>rather</i> , dearer; lieber, <i>often</i> , to prefer to eat.
Wien, <i>profr.</i> away.	Sich es wohl sein lassen, to make one's self comfortable.	Über, <i>past</i> , over.
Wienbett, <i>n.</i> flower-bed. (Bet, <i>n.</i> bed [in a garden.])	Recht, <i>very</i> , right.	Verreiben, to drive from their inhospitable homes, and were pressing closer and closer upon the borders of the empire.
Wüßer, <i>out of</i> , beside.	Surück, <i>back</i> .	Verreiben, to drive away, to expel. (reiben, to drive.)
Bald, <i>soon</i> .	Wissen, to be obliged.	Wirklich, <i>really</i> .
Ginige, <i>pl.</i> some.	Herbst, <i>n.</i> autumn.	Wissen, to know.
Gespieler, <i>m.</i> play-fellow	Subringen, to spend	Verfahren, to continue.
Nächst, <i>next</i> .	Sei, <i>hot</i> .	Tasche, <i>f.</i> pocket.
Dorf, <i>n.</i> village.	Seit, <i>serene</i> , cheerful	Seite, <i>f.</i> page, side.
Dorf, <i>n.</i> village.	Weinstock, <i>m.</i> vine. (Stod, <i>m.</i> stick.)	Sonderbar, <i>singular</i> , strange.
Grün, <i>green</i> . [seed.]	Reif, <i>ripe</i> .	Nacht, <i>to reflect</i> .
Saat, <i>f.</i> cornfield.	Reife, <i>f.</i> grape.	Folgen, to follow.
Tausend, <i>thousand</i> ;	Mist, <i>n.</i> hot-bed. (Mist, <i>m.</i> manure.)	Wannigfaltig, <i>manifold</i> .
fällig, <i>adj.</i> fold.	Zweig, <i>m.</i> branch.	Einrichten, to arrange.
Schmücken, to adorn.	Niederzehen, to bend down. (ziehen, to draw, march, move.)	(richten, to right, judge.)
Aue, <i>f.</i> meadow.		
Mutwillig, <i>playful</i> , wanton.		
Füllen, <i>n.</i> colt, foal.		

HISTORIC SKETCHES.—XXXIII.

THE PAPACY.

TIME was, when there was no Pope of Rome, even though Christianity had been established in the world's capital for many years. Time was when, though there was a Pope, or Father, or Bishop of Rome, there was no pontiff king; when the See of St. Peter, as it has been called, was ruled in spiritual matters by men who came up—and more than came up—to the standard of qualifications set by St. Paul for those who would assume the office of bishop; men who administered to their brethren in spiritual things humbly, and with an ever-present sense of the responsibility of their charge; "not making themselves lords over God's heritage," but administering soberly, fatherly, wisely. At this time the Roman Christians were not under papal scrutiny, and the idea of secular authority—temporal power—would have been looked on not only as incompatible with true spiritual power, but as preposterous and entirely out of character with the province of a bishop. Let us look back a little upon the Rome of former days, and watch through the telescope of time the gradual growth of that enormous dominion over the minds and consciences of men which is now included in the Papacy, and the growth also of that other subsidiary power, which includes the power of the sword, the power which when St. Peter, in a moment of generous impulse, arrogated to himself and exercised, he was bidden by his Lord to forego it, and to put up his sword into its sheath.

Christ died in the thirty-third year of his age, and the apostles and their successors, beginning from the feast of Pentecost, preached the Gospel of his kingdom both in the East and West with singular success. Not without much suffering and persecution did they achieve their work; many were the witnesses to truth who were required to lay down their lives for the sake of Him who had in his own person shown them how to die and how to overcome death. The noble army of martyrs had increased to a prodigious size ere Constantine, the first Christian Emperor of Rome, gave relief to its weary battalions. The Church, during 300 years that it suffered violence, lived a life purified by suffering, so that dissensions were few and heresies almost unknown—at least in that portion of the Church which was immediately exposed to persecution. In Rome, for example, whatever there might be in the Churches of Africa and Asia, there was, comparatively speaking, unity; the presbyters, or bishops, were just the heads of congregations, chosen by the congregations as being the fittest for the post; and they were possessed of an authority not aggressive, and which was capable of being curbed, if need were, by the voice of the other presbyters, or of the congregation itself. There was no pretence of infallibility in any one; but quietly, with singleness of heart, in profound humility, and in daily waiting upon the Lord of the Church, the Roman Christians lived and died, worked and prayed; their services being simple and un-Judaized by cere-

monies, their chief and daily service the communion of the body and blood of their Lord, whose death they lovingly desired continually to set forth till his coming again.

Between A.D. 324 and 334 the Emperor Constantine built the city which was called after him Constantinople; and removing the court thither, made it the seat of government and the capital of the empire. Rome lay too open to the attacks of the northern and western men, who were coming down gradually from their inhospitable homes, and were pressing closer and closer upon the borders of the empire. The empire, vast and unwieldy as it was, was beginning to feel the fatigue of supporting its own body, and Constantine was anxious to withdraw to a spot where his authority was more unquestioned than in the West. The effect of Constantine's conversion was to bring about the conversion of many lesser potentates, whose people, prepared for the change by the zealous, self-denying Christian missionaries, speedily followed. Thus the kings and people of Iberia, Armenia, of part of Abyssinia, and of India became Christians, while large numbers of the Goths and Germans in the Imperial army embraced the same faith. The national religion of the Roman Empire, or as it was now called, the Greek Empire, was changed from paganism of various kinds to Christianity.

The Church scarcely thrived so well under prosperity as under adversity; but one of the first things done for her under the new régime was to give her the emperor, a layman, for her head. Constantine was acknowledged to be the supreme head of the Church, because it was deemed necessary to have some head; and the wisdom of the time—and of any time—could think of no one better than the man who was the Church's protector and champion, and who, being a layman, without any pontifical attributes, could not be suspected of spiritual despotism. The Church was administered by 1,800 bishops—1,000 in the Greek, and 800 in the Roman provinces—whose dioceses varied in extent, according to the population, but whose rank was equal. These bishops were elected by the clergy and the people of the diocese, the emperor claiming a right to interfere in their final appointment if he thought fit. But soon there was established by Constantine himself a distinct order of ecclesiastics—bishops who, once appointed, were absolute over their clergy, and who had the power, among other things, to excommunicate those whom they deemed fit subjects for it. The secular arm was lent to enforce the sentences of these rulers, who were compared with the other prelates as archbishops to bishops; but even among these privileged few distinctions were soon taken, according to which Rome, Alexandria, Antioch, Carthage, and afterwards Constantinople, were selected to form patriarchates, or primacies.

Councils met in the spring and autumn of each year to consider the affairs of the whole Church. Archbishops could summon to council all their dependent bishops and clergy, and the patriarchs could do the same by the whole of the clergy in their see; but an extraordinary council, or grand synod, containing representatives from all Christendom, could be summoned by the emperor alone. At the grand synod were discussed matters affecting the whole Church of Christ, and as it was supposed that the Spirit of God must necessarily be present among those who were met to decide upon the affairs of the flock, it came to be maintained that a General Council was infallible, and superior to the Pope—a doctrine which has obtained in the Roman Church ever since. As an instance of this, the General Council of Constance, in 1414, even deposed Pope John XXIII., and elected Martin V. in his place.

In the seventh century the followers of Mahomet (Mahomet died A.D. 631) streamed northward and westward from their Arabian home, and swept away the patriarchates of Antioch and Alexandria, establishing the crescent in the place of the cross. The see of Antioch had never been very powerful, but that of Alexandria was, perhaps, the first of all—first in point of numbers, first in bigotry, first in power. It was corrupt, and it fell before the Saracens, and the Christian Church in Africa has never taken deep root since. Carthage soon followed the fate of Alexandria, and schism springing up between the Churches of Rome and Constantinople, the former was left to pursue that policy of self-aggrandisement which it has laboriously carried out, wherever practicable, ever since.

A remarkable chain of circumstances contributed to the development of the Roman policy. About the year 728 the

Romans—neglected by the emperor at Constantinople, whose power was sensibly diminishing year by year—found themselves obliged to take measures for preventing their community falling into a state of anarchy, and for putting it in a posture of defence against external enemies. They formed themselves, therefore, into a sort of dependent republic, much in the same way that Milan, Venice, and other Italian cities had done; and as was perhaps natural, they solicited their bishop, as the most influential man among them, to give them the benefit of his advice in the conduct of affairs. At first it was by request that he took part in their councils; then, seeing the political advantage of such a position, the bishop began to acquire a prescriptive right to be consulted in all the business of the city. He had spiritual authority over the whole of the Western Empire, and in places where the decree of the emperor would not have been recognised his order was obeyed without question by those whom the zealous missionaries had taught to look upon the Bishop of Rome as their divinely-appointed head. The half-barbarous kings and princes who ruled in Western Europe acknowledged him as Patriarch, while all Western bishops everywhere admitted that whoever was Bishop of Rome was their Pope, or Father in God. The Romans thought that such a man, in correspondence with many princes, and of great influence throughout the West, would be able to save them from the evermore threatening invasions of the "barbarians." They offered the Pope the temporal government of their city, and he, not answering them with any assertion that his kingdom was not of this world, accepted it, and became autocrat of Rome. The emperor allowed the arrangement, and so things went on, and in 730 the people saw the effect of what they had done, when Luitprand, King of the Lombards, flushed with victory and spoil, was stopped even at the gates of Rome by the remonstrances of Pope Gregory II.

In 754 Astolphus, successor to Luitprand, seized on Ravenna, the rival see of Rome, abolished the exarchate, or civil government there, together with the spiritual, and annexed the city to his dominions. He thought to do the same by Rome, which he summoned to surrender. Stephen II., who became Pope in 752, had foreseen what was coming, and had applied to King Pepin, son of Charles Martel, for assistance. That prince, as the son of a usurper, was only too glad to arrange an alliance with so useful a person as the Pope of Rome. He marched to his assistance, drove Astolphus back, and when, Pepin being gone, Astolphus returned, he once more came down with an army, and utterly routed him. This was no small matter; but when in the reign of Desiderius, the next Lombard king, the attacks on Rome were renewed, and Charlemagne came down with a force which crushed resistance, destroyed the kingdom of Lombardy, and annexed it to his own empire, the benefit to the Romans exceeded all their hopes. In the year 800 Charlemagne came in person to Rome, and was elected, at the Pope's suggestion, emperor, by people who had not the faintest right to confer the title. But that made no difference. The title was what was wanted, and the Emperor of the West was crowned solemnly by the Pope, who in return was confirmed in his office, and was given in fee and to hold, under his temporal sway, the territory that was held by his old rival, the Archbishop of Ravenna.

Fifty years afterwards (A.D. 858) a monk of Mayence, named Isidore, announced that he had discovered the decretals of the Popes of Rome from the time of St. Peter; in other words, a set of papal decrees, which pretended to have the assent of the emperors and the people, and which contained the most uncomplimentary assertions that if the papal kingdom was of the other world, it was of this world also, for as Christ was above all earthly things, so his vice-gerent must be above them too, and by an easy process of reasoning the kingdoms of this world were demonstrated to belong to the Pope. Adrian I. many years before had written to Charlemagne—after the bestowal of his gifts—to say that a deed of gift by Constantine had been discovered, from which it appeared that Constantine, having been cured by baptism of a leprosy, was so grateful to St. Sylvester, Bishop of Rome, that he declared his intention of going to live at Constantinople, in order that the Pope might possess Rome, and all the Western Empire, spiritually and temporally.

Belief was given to the decretals, and to the gift of Constantine, though they have long since been disavowed by the Roman

Church. Both documents were shameful forgeries. Upon them, and upon the actual gifts to the Papacy, was reared the fabric of the temporal power, which not only pretended to have authority within what were called the States of the Church, but to be, by divine right, freeholder and lord paramount of all the kingdoms of the earth, claiming even the right to dispossess kings, in the event of their proving disobedient. This sort of pretension was bound sooner or later to produce a disturbance, since the emperor claimed the right which Charlemagne exercised, of confirming or rejecting the election of Pope by the Roman people. Gradually the patient diplomacy of the Court of Rome prepared for the contest which came with might about the year 1060. In 1058 Nicholas II. took away from the Romans the right to elect their Pope, and gave it to the cardinals or hinges of the Church, whose voices alone were to decide the matter, and who generally selected a Pope from among their own body. This was a preparatory step.

The Emperors of Germany—descendants or representatives of that Charlemagne who had been elected and crowned Emperor of the West at Rome in the year 800, and who had ever insisted on his power to approve or displace the Pope of Rome himself—were informed that they must not only renounce their right in the case of the Pope, but in the case of all the other clergy in their dominions, and that they must regard themselves as the vassals of the See of Rome. Broadly stated, this was the issue on which commenced in the year 1061 the wasteful and cruel faction wars of the Guelphs (Welf) and Ghibelines (Waiblingen) which set all western Christendom by the ears for over two centuries. The Guelphs represented the papal party, which was made up of some powerful and many minor princes of Europe; the Ghibelines represented the empire and its adherents. Sometimes one side had the advantage, sometimes the other; the emperor was more than once utterly defeated, and in peril of his life; at another time the emperor had the satisfaction of seeing Rome at his feet. All the quarrels of Europe for a while worked into this quasi-religious war; the malcontents with the emperor siding with the Guelphs temporarily, till they had attained their object, and then being quite ready to assist the emperor against his permanent foes. But, on the whole, the Papacy sucked out no small advantage from the contest, and in the long run may be said to have been the winner. In 1076, when Gregory VII., the famous Hildebrand, was Pope, the Countess Matilda gave the whole of her possessions, including the greater part of Italy between Piedmont and Rome, to the Pope; and this gift, with the gifts already in possession, made the spiritual head of the Church, the "servant of the servants of God," a formidable temporal power.

The whole of the vast authority wielded by the Roman priesthood was made to subserve the purpose of exalting the sovereign pontiff over all other rulers, and, as might have been expected, Christ's work remained undone; "the hungry sheep looked up and were not fed," abuses and corruptions of all sorts abounded, and the supply of salt was low wherewith to savour the earth. From time to time men stood forth and denounced spiritual wickedness in high places, but for the most part darkness covered the land, and gross darkness the people; the blind led the blind, with the inevitable result; and men became so accustomed to the dark, that they were confused and annoyed when the light came. But the very excess of corruption in the Papacy brought about the cure of the disease, at least over great part of Christendom. When Leo X., in 1517, tried to replenish his coffers by selling, through travelling agents, indulgences for sins not yet committed, the spirit of the German people rebelled, and Luther fired the train which led to the explosion of the Reformation. The Reformation was a fatal blow to the universal spiritual ascendancy of the Roman bishop; but his temporal power remained as before, till Napoleon Bonaparte overthrew the papal power with that of all the other princes in the peninsula. The papal administration of the civil government was oppressive and life-killing in the extreme. The government had been a scandal to Europe, but so great was the revulsion of feeling after the fall of Napoleon, the destroyer of kingdoms, that it was restored, and the Italians were handed over, bound tighter than before, to the guardianship they hated and despised. It was reserved for our day, and for our eyes to witness, the destruction of the temporal power of the Pope, and the establishment of a united Italy.

LESSONS IN LATIN.—XXXII.

DEPONENT VERBS—THIRD CONJUGATION.

EXAMPLE.—Loquor, I speak.

Chief Parts: Loquor, loqui, locutus sum.

PRESENT TENSE.

Indicative.	Subjunctive.	Imperative.	Infinitive.	Participle.
Sing. Loquor, I speak, etc.	Loquar, I may speak.	Loquere, thou, etc.	Loqui, to speak.	Loquens, speaking.

Loqueris.	Loquaris.	Loquere, thou, etc.	Loquitur.	Loquatur.
Plu. Loquimur.	Loquamur.	[quiminor.	Loquimini.	Loquamini.
Loquuntur.	Loquantur.	Loquimini, lo-		

IMPERFECT TENSE.

Sing. Loquebar, I was speaking, etc.	Loquerer, I might speak.	Loquebaris.	Loquereris.
Loquebatur.	Loqueretur.	Loquebamini.	Loqueremini.
Loquebantur.	Loquerentur.		

FIRST FUTURE TENSE.

Sing. Loquar, I shall speak, etc.	Loqueris.	Loquetur.	Locuturum, on the point of speaking.	Locuturus, on the point of speaking.
Plu. Loquemur.	Loquemini.	Loquentur.		

PERFECT TENSE.

Sing. Locutus sum, I spoke, etc.	Locutus sis, I may have spoken.	Locutus es.	Locutus sis.
Locutus est.	Locutus sit.	Plu. Locuti sumus.	Locuti sitis.
Locuti estis.	Locuti sint.		

PLUPERFECT TENSE.

Sing. Locutus eram, I had spoken, etc.	Locutus eras.	Locutus eras.	Locutus eras.
Locutus erat.	Locutus esset.	Plu. Locuti eramus.	Locuti essetis.
Locuti eratis.	Locuti essetis.	Locuti erant.	Locuti essent.

SECOND FUTURE TENSE.

Sing. Locutus ero, I shall have spoken, etc.	Locutus eris.	Locutus erit.	Locuti erimini.
Locuti eritis.	Locuti erint.		

GERUNDS.

Gen. Loquendi, of speaking.	Det. Loquendo, to speaking.	Acc. Loquendum, speaking.	Ab. Loquendo, by speaking.
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SUPINES.

1. Locutum, to speak.	2. Locutu, to be spoken.
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After this model conjugate the following deponent verbs:—Sequitur, sequi, secutus sum, to follow; fungor, fungi, functus sum (with abl.), to discharge; labor, labi, lapsus sum, to fall; obli-viscor, oblivisci, oblitus sum (with gen.), to forget.

VOCABULARY.

Ad aliquid, for an ob-	Discedo, discedere, dis-	Nascor, nasci, natus
ject.	cedi, discessum, 3, to depart.	sum, 3, to be born, to arise; part. future, nasciturus (E. R. nascent).
Aditor, 3, to strive for.	Expergiscor, exper-	Nitor, niti, nixus, or
Angulus, -i, m., a corner.	gisci, experrectus sum, 3, I arise.	nissum (with abl.), 3, to lean, to depend on, endeavour.
Complexor, complecti, complexus sum, 3, to embrace.	Fruor, frui, fructus and fructus sum, to enjoy.	Paciscor, pacisci, pactus sum, 3, to make a treaty or agree-
Congredior, congrēdi, congressus sum, 3, to come together, meet, fight (E. R. congress).	Gratia, -æ, f., gratitude, favour, thanks (E. R. grateful).	ment.
Cumulo, 1, to heap up (E. R. accumulate).	Innascor, 3, to be born in.	Parum diu, too short a time.
Detestabilis, -e, to be shunned, detestable.		

Persevero, 1, to perse-	Semen, seminis, n., seed.	succurri, succurrum, 3, to aid, succour (with dat.).
vere.	Simulatque (simul and atque), as soon as.	Ulciscor, ulcisci, ultus sum, 3 (with acc.), to avenge yourself, punish.
Postis, -is, f., the plague.	Superior, -ioris, m., a superior, conqueror.	Vision, -is, n., sight, ap-
Quotiescunque, as often as.	Superior discedo, I come off conqueror.	pearance.
Revertor (perfect), re-	Succorro, succurrere,	
verti (participle), re-		
versus, 3, to return (E. R. reverse).		

EXERCISE 114.—LATIN-ENGLISH.

1. Salus hominum non veritate solum sed etiam fama nititur. 2. Cives, cum hostibus pacti, pace frui sunt. 3. Deum et divinum animum cogitatione complectimur. 4. Lacte, carne, multisque aliis rebus vescimur. 5. Caveto ne ulciscamini inimicos vestros. 6. Romani Numidis hoc polliciti sunt. 7. Numidi perseveraverunt bello urgere Carthaginienses. 8. Romani adnisi sunt. 9. Romani se adnisiuros esse dicunt. 10. Cumulatam gratiam reddiderunt Romani. 11. Romani Numidis polliciti sunt, si perseverarent bello urgere Carthaginienses, se adnisiuros esse, ut cumulatam gratiam redderent. 12. Nemo parum diu vixit, qui virtutis perfectio functus est munere. 13. Vi a in somno contemnunt sapientes. 14. Simulatque experrecti sumus, contemnimus visa in somno. 15. Aristoteles, Zeno, innumerales alii, e patria profecti, nunquam domum reverterunt. 16. Nulla tam detestabilis est pestis quae non homini ab homine nascatur. 17. Non sum uni angulo matus. 18. Patria mea totus hic est mundus. 19. Sunt ingenis nostris semina innata virtutum. 20. Hannibal cum Romanis congressus est in Italia. 21. Hannibal cum Romanis congressus, semper discessit superior. 22. Hannibal, quotiescunque cum Romanis congressus est in Italia, semper discessit superior.

VOCABULARY.

Ad aliquid, to strive after.	sum, 3, to struggle out, to do our best.	Quo, whither.
Adipiscor, adipisci, adeptus sum, 3, to attain, acquire.	Excedo, excedere, excessi, excessum, 3, to go out (with abl.), to go out of, or beyond (E. R. excess).	Recent, -tis, recent, fresh.
Avidus, -a, -um, eager for, greedy of.	Irascor, irasci, iratus sum, 3, to be angry, acquaintance.	Regia res est, it is like a king, or worthy of a king.
Carco, 2, to be without.	Lapsus (labor), fallen, the fallen.	Regius, -a, -um, royal.
Consuetudo, -inis, f., consuetudine.	Nefas (indeclinable), n., wickedness, something too bad to be spoken of (from for, fari, fatum).	Stultitia, -æ, f., folly (E. R. stultify).
Defetiscor, defetisci, defessus sum, 3, to be weary.	Nefas (indeclinable), n., wickedness, something too bad to be spoken of (from for, fari, fatum).	Tendo, tendere, tetendi, tentum, 3, to stretch, extend.
Diuturnitas, -atis, length of time.	Patior, pati, passus sum, 3, to suffer.	Ubique, wherever.
Elabor, elabi, elapsus sum, 3, to slide, get away.	Proprius, -a, -um, one's own, peculiar.	Ubique gentium, in whatever part of the world.
Enitor, enisus, enixus		Vicinitas, -atis, f., neighbourhood.

EXERCISE 115.—LATIN-ENGLISH.

1. Optimi ejusque animus maxime ad gloriam immortalem nititur. 2. Hostes diuturnitate pugnae defessi sunt. 3. Hostes diuturnitate pugnae defessi, prelio excedebant. 4. Adeptus est virtutem. 5. Ubique gentium erit vir bonus, ab amicis diligetur. 6. Qui virtutem adeptus erit, ubique erit gentium, a nobis diligetur. 7. Avida est periculi virtus. 8. Virtus quid passura sit non cogitat. 9. Avida est periculi virtus, et quo tendat, non quid passura sit cogitat. 10. Augustus dominum se appellari non est passus. 11. Animalia alia rationis expertia sunt, alia ratione utuntur. 12. Animo elapso, corpus nihil valet. 13. Valet apud nos clarorum hominum memoria, etiam mortuorum. 14. Regia res est, succurrere lapsis. 15. Proprium est stultitiae, aliorum vitia cernere, oblivisci suorum. 16. Ut plurimum proximus, eniti debemus. 17. Irasci iis quos amare debemus est nefas. 18. Amicitia, consuetudines, vicinitates habent aliquid voluptatis. 19. Cercando magis quam fruendo intelligimus bona nostra. 20. Amicitia, consuetudines, vicinitates quid habeant voluptatis, cercando magis intelligimus quam fruendo. 21. Semper recentes defessis succedebant.

EXERCISE 116.—LATIN-ENGLISH.

1. Happiness depends on virtue. 2. Does happiness depend on man? 3. No, happiness depends on God. 4. We ought to do our best to cultivate virtue. 5. The father embraced his son. 6. The son avenged the death of the father. 7. The king promised a reward. 8. Did the queen promise a reward to your sister? 9. The soldiers will endeavour to attain heaped-up glory. 10. In the morning they arose and departed. 11. They have well discharged the duties of life. 12. Aristotle and Zeno discharged the duties of preceptors. 13. When will your friends return home? 14. They returned home yesterday. 15. They went from their country, and will never return. 16. This plague is borne in the minds of men. 17. Where is your country? 18. My country is the world. 19. The seeds of vice are inborn in human souls. 20. The general fought with the enemy. 21. As often as the English generals fought with their enemies, they came off conquerors. 22. The mind of every very good boy very greatly loves his

parents. 23. The good strive for salvation (literally, safety of soul). 24. Boys and girls live on milk. 25. The scholars have discharged their duties. 26. Pity the fallen, O God. 27. Succour the poor. 28. It is peculiar to folly to do good to no one.

You may make great progress in a knowledge of syntax, as you pass on through these exercises on the formation of the verbs, if you will carefully mark the various forms and constructions that come successively under your notice. With a view to aid you in this, I mark any considerable deviation: for example, when a verb has its object not in the accusative case, but the objective, I introduce the abbreviation *cum dat.*, which means that the verb requires its object to be in the dative case. But I cannot impress it too deeply on your mind, that it is mainly by your own observations, by your own reflections, generally by your own studies and efforts, that you can acquire an acquaintance with the Latin, or, indeed, any other branch of knowledge. There are many, very many peculiarities which I have not here space to point out. You, too, have difficulties of which I am not aware. It is only by attention and diligence on your own part that the one can be learned and the other overcome. Study every lesson in all its parts and relations with the utmost care. Go over every lesson again and again. What you do not see now you will see by and by; and what you do not understand now you will understand hereafter.

KEY TO EXERCISES IN LESSONS IN LATIN.

EXERCISE 110.—LATIN-ENGLISH.

1. You had scarcely confessed your fault, when your father pitied you. 2. You had already admitted that you had erred, when you denied it again. 3. We had not yet entreated your assistance, when you promised it to us. 4. We had scarcely confessed our want, when you most freely promised us your assistance. 5. There is great power in philosophy when it heals our minds, and removes vain anxieties. 6. The arts afford us great assistance when they severally support themselves independently. 7. Teachers serve their country well (deserve well of their country), when they instruct the youth by the study of useful letters. 8. When philosophy heals our minds, we ought to give up ourselves wholly and thoroughly to it. 9. All pitied you, since you were in wretched (circumstances), not in consequence of wickedness, but on account of fortune. 10. Since the soldiers feared dangers, they dared not to fight with the enemies. 11. The covetous (man), though he is extremely rich, will not admit that he has enough. 12. Take pity on us; O citizens, relieve our want. 13. Let each defend his son. 14. No one, beholding the whole earth, will doubt concerning the providence of God. 15. The citizens, thinking that the enemies were about to attack the city, strove most energetically to drive them back. 16. I come to promise (about to promise) you my assistance. 17. It is the duty of a young man to reverence his elders. 18. You ought in every way to relieve the want of the citizens. 19. Who knows not that you have served the republic well? (that you have deserved well of the republic). 20. I hope that you will pity me.

EXERCISE 111.—ENGLISH-LATIN.

1. Peccata sua fassi sunt. 2. Peccata sua fatebantur. 3. Fassin erant peccata? 4. Peccata sua non fatebatur. 5. Soror mea peccata fassa est. 6. Adolescentes negant se peccata fassuros esse. 7. Religio hominum animis medetur. 8. Solum religio vera hominum animis mederi potest. 9. Religio semper bonorum animos sanavit. 10. O mi pater, miserere mei. 11. O Deus, miserere nostri. 12. O Deus, hominum cunctorum miserere. 13. Coniux quisque tuorum uxorem suam. 14. Adolescentes, milites domos suas oppugnatos nati, prae metu se interfecerunt. 15. Artes ipsae singulae artifices tuerunt. 16. Tuentur artes ipsae se? 17. Artes artifices tuitae sunt, et tuerunt, et tuebantur. 18. Intuere coelum, et Deum vereberis. 19. Virtutem intuentes, homines sunt sapientes. 20. Praeclare de republica meritis est. 21. Regina praecclare de republica meruit. 22. Milites praecclare de patria meriti sunt. 23. Praecclare de domo mereri non possum. 24. Intuetur virtutis exemplar. 25. Fatetur peccata, et veniam impetrat. 26. Confessi peccata veniam impetraverunt. 27. Quam peccata confessi sitis, veniam impetrabitis.

EXERCISE 112.—LATIN-ENGLISH.

1. Why do we not fear the veterans? because not even they themselves wish to be feared. 2. We venerate you, Romans; and if you so desire, we even fear you. 3. Let her not be afraid to enter into the house of another. 4. I fear that I am walking out with this ornament for the sake of (exciting) love rather (than for anything else). 5. I shall not cease to be apprehensive about Carthage, until I have ascertained that it is demolished. 6. I fear that Dolabella will not be able to benefit us sufficiently. 7. I received your letter, by which I understood that you were afraid, lest the former (letter) had not been delivered to me. 8. He was afraid, lest he should hurt the mind of Divitiacus by the punishment of that man. 9. I fear if I begin to

explain this thing, I shall seem not to be narrating a life, but to be writing a history. 10. I do not fear that I shall satisfy you by writing. 11. I do not fear you will do anything timidly, anything foolishly. 12. I do not fear that the moderation of my life will prevail too little against false rumours.

EXERCISE 113.—ENGLISH-LATIN.

1. Veretur parentes, regem timent. 2. Tyranni timentur. 3. Tyrannos timebunt. 4. Parentes meos verborum. 5. Non veretur ne verbis te expleam. 6. Timetis in hostium castra introire. 7. Vereor ne frustra legam; de patria metuunt ne excedatur. 8. Timeo ne mater veniat. 9. Quid times ne mater veniat? 10. Quia contra praeccepta sua ago. 11. Metuunt ne patruus mortuus sit. 12. Metuo ne Dei ira in hanc urbem incidat. 13. Vita tua contra calumniam valeat. 14. Ne verearis ne vita tua contra malorum calumniam non valeat. 15. Vereris ut tibi prodesset possim. 16. Ne verearis nequid stulte faciam. 17. Frater meus non veretur nequid stulte faciam.

COMPARATIVE ANATOMY.—XIV.

POLYZOA (BRYOZOA) AND TUNICATA.

In the last lesson we concluded our necessarily short account of those animals which belong to Cuvier's great branch of articulated animals. We turn from a description of these to review those classes which belong to the other great collateral branch of molluscous animals with some degree of regret. For while the Mollusca present many points of interest, and, like all the works of God, are well worthy of study, yet their peculiar excellences are less attractive in their nature than those of the Articulates. The organs of animals may be classified under two great divisions, according to the nature and object of their functions: namely, those which animals possess in common with plants, and which minister to the nutrition of the individual and the reproduction of its kind; and those which belong exclusively to animals, and subserve the objects of motion from place to place, the perception of outward objects, and the search for, collection, and capture of these. The first class, which are, of course, the more general and necessary, are called the organs of organic life; while the last are superadded to the others, and are called the organs of animal life. It is true that the first class of organs must lie at the foundation of all life, and are, therefore, in one sense, the most important; but since the other class seems to be the connecting link between mere vegetative existence and the self-conscious life of man, with all its mental phenomena, we cannot but regard these last as of a higher order. Now the excellence of the Mollusca is, as we have before stated, in the perfection of their organs of organic life, while the Articulates exhibit a marked superiority in the organs of animal life. We are, therefore, now turning from those animals whose organs of sense, locomotive apparatus, nervous and muscular systems, and correlated instinct have been such sources of wonder, to examine animals in which these organs and systems of organs are made a secondary consideration to those of the alimentary, secretory, excretory, and reproductive systems. However delusive may be the analogy between instinct and reason, we cannot but feel a certain kind of sympathy with creatures endowed with great active powers, and who adapt these to the attainment of ends which the reason declares desirable. Perception and volition—the power of knowing and acting—may, in a certain sense, be attributed to insects; and although these powers are, doubtless, very different in their nature to the powers which pass by the same name of which we are conscious, yet they have something in common, and in their manifestation they are so alike, that it is only by a strict analysis that we can dissociate them. Prove as we may that the habits and instincts of the honey-bees, as manifested in their social economy, in the collection of wax and its application to the construction of their admirable cell architecture, in storing the pollen of flowers for feeding their young, and of honey for winter food, are evidences of no higher perception and powers, so far as the insects are concerned, than those which are shown by ourselves when we wink our eyes when a grain of sand is blown towards them, or when we snatch away our hands from a scorching flame; yet our imaginative faculty will not permit us so to regard the subject. Perhaps the connection between instinct and reason is not quite so delusive after all, and probably we may have to look for the origin of many of the opinions as well as the practices of men in those instincts which we possess in common with the lower animals. To say the least of it, the glory and the wisdom of the great Creator loses nothing by being in part

attributed to the little winged creature from which it is reflected.

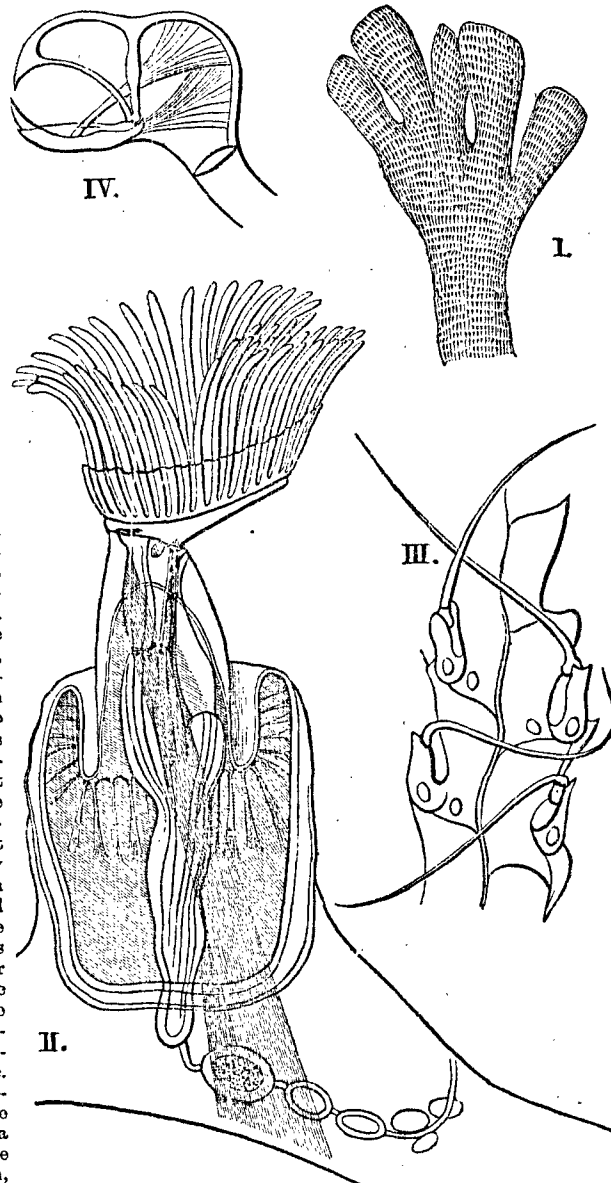
In the Mollusca instincts are not wanting, and locomotive and perceptive powers are also evidenced; but they are wholly inferior in these faculties to the Articulata, and in turning to them we feel to be turning from the higher modes of life to the lower. The body of the insect is so fitted for rapid and dexterous action that it seems to have become almost ethereal; while in the slug the very senses seem to be dulled to suit the requirements of the coarser material parts.

For a further contrast of the Articulata and Mollusca we must refer the reader to a former lesson. It suffices here to mention one or two points of general structure which are intimately connected with the habits of these creatures. First, since the Mollusca are less adapted for locomotion than other animals, the requirements which swift locomotion dictates are not insisted on with such strictness. Rapid locomotion necessitates what is called bi-lateral symmetry—that is, that the body shall be precisely alike on both sides. This, accompanied with an elongated form, whose axis is in the line of locomotion, is the form best suited for advance. A ship is better than a tub for locomotion, and the keel must not only be straight, but the hold must not be lopsided. Thus we found that in the insect every part, down to the shape of the nerves in its netted wings, is accurately represented by its counterpart on the other side. In the Mollusca, however, this symmetry is not essential, and it is liable to be dominated by other requirements. A pecten (scallop) lies on its side, and hence has one side flat and the other rounded. A snail has its body rolled into a spiral for compactness' sake, and for the convenience of having a large orifice for its respiratory chamber; that spiral is not equilateral, but twisted to one side. Secondly, since rapid locomotion is not the first object, the walls of the body represent a rounded bag to contain the viscera, rather than a fulcrum, upon which lever-like limbs are pried; and hence it is always soft and flexible, and the limbs are not jointed organs, but lobes or protrusions of the bag wherewith to crawl or grasp, not to raise or propel. Thirdly, since protection is not sought in flight, it is afforded in a structure which would impede flight, and the creatures, when on the defensive, retract and nullify all their feeble locomotive apparatus, casting themselves wholly on the defensive efficiency of their shells.

The lowest class of the Mollusca is widely different from the more typical classes, and the structure of its representatives seems to indicate that the starting-point of the molluscan classes

is directly from the Hydroid Cœlenterata. These creatures are compound animals—that is, the product of a single egg or reproduced animal may grow into a multitude of similar heads or parts, each one of which has all the essential organs of life, and can live when detached; hence their name Polyzoa, or multiple animals. The plant-like growth of these compound animals is a process of budding, but it is carried on in very various directions. According to these directions and methods, very various aggregate forms are produced. In many instances it results in an incrustation composed of closely-set cells. These crusts spread from a point, and often closely invest sea-weeds and rocks. They seem to have a special partiality for the shells of other Mollusca, exercising, however, a discrimination by affixing themselves rather to the shells of the less locomotive bivalve Mollusca than to those of the univalves. Thus they have the benefit of a slight change of place without being subject to abrasion by constant locomotion. These incrustations so much resemble the clothing of moss which spreads over stones and walls, that some naturalists have applied the name of *Bryozoa* to these animals, a term which signifies moss-like animals. The crusts are to be found by any one who examines objects which are generally covered by the sea, and, when examined by the naked eye, they look like fine lace of different patterns. So great is the diversity and beauty of these forms that they repay even this superficial investigation. The Polyzoa have existed from a very early period in the history of the earth, and they then had the same habits, as a class, as they now have. This is evident from the fact that no one can make a collection of fossil shells without also collecting many of the Polyzoa attached to them. In these cases they are usually attached to the outside of the shells. When they are found covering the inside of the shell, of course this is a proof that the shells remained for some time at the bottom of the ancient sea after the death of their owners, before they were covered with the mud or sand of the deposit in which they are found embedded. One comparatively recent formation is so full of the remains of these creatures as to be called the *Coralline Crag* of Suffolk. This name was given when the creatures were supposed to resemble coral polypes (Actinizoa), and now that they have been discovered to be of higher standing in the animal scale, and, in fact, to belong to an altogether different sub-kingdom, of course the name is inappropriate.

Sometimes the crusts do not cling closely to the substance from which they spring, but rise up from it. In such cases the free frond may be flattened, being, in reality, two crusts placed



POLYZOA.—I. FLUSTRA. II. PLUMATELLA REPENS (ONE POLYPE) CUT OPEN TO SHOW INTERNAL ORGANS. III. SCRUPOCELLARIA, SHOWING VIBRATILE ORGANS. IV. ARICULARIUM, WITH MUSCLES THAT FLY IT.

tion is so full of the remains of these creatures as to be called the *Coralline Crag* of Suffolk. This name was given when the creatures were supposed to resemble coral polypes (Actinizoa), and now that they have been discovered to be of higher standing in the animal scale, and, in fact, to belong to an altogether different sub-kingdom, of course the name is inappropriate.

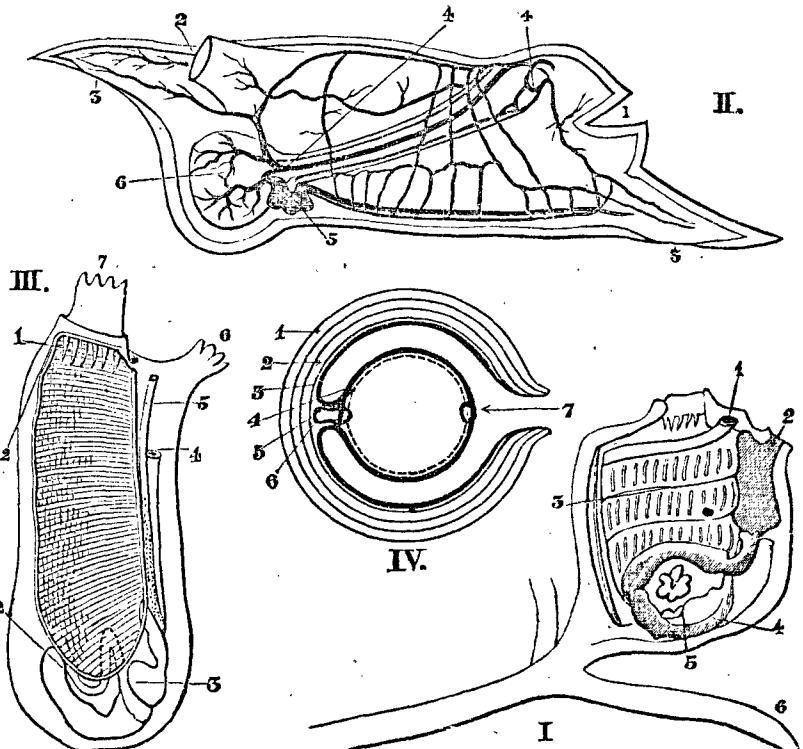
Sometimes the crusts do not cling closely to the substance from which they spring, but rise up from it. In such cases the free frond may be flattened, being, in reality, two crusts placed

back to back, and mutually supporting each other. This is the case with the ordinary sea-mat (*Flustra maxima*), which is one of the largest of these compound animals, and may have been often mistaken for a sea-weed by the casual observer. In other cases the stems, instead of being wide and flat, may be much narrower, presenting single or double chains of cells, which branch and spread freely in the water. In some rarer instances the whole compound animal is locomotive, the crust, with its many cells, and their contained simple zooids, travelling, by common consent, in one direction. It will be seen by the above description that the outward form of these creatures is closely paralleled by those of the Cœlenterata, and when to this outward resemblance is added the fact that each of the simple animals which occupy the cells has a head almost precisely similar to the Hydrozoa, it is not surprising that they should have long been confounded with them. A mouth, surrounded by a circle of tentacles capable of motion, is characteristic of both the compound Hydrozoa and the compound Polyzoa; but it was early observed that the tentacles of the latter were always clothed with cilia, while those of the former were unfurnished with them. The reader of these lessons will remember the nature of the organs called cilia, and the nature of their action as described when the Rotatoria were treated of. By the aid of these organs currents are set in motion and directed towards the funnel-shaped mouth, and thus small particles of food are procured in addition to that which can be obtained by the action of the whole tentacle, or of many of these

acting together, when they seize a larger prey in the same way as the Hydrozoa obtain the whole of their food. A difference of this superficial character, founded on organs which clothe the outside of the animals, did not at first seem sufficient to justify any great division being constituted between the Polyzoa and Cœlenterata polypes, and hence they were called ciliated polypes. But it was soon found that this external difference was associated with a fundamental difference in the internal organs. The food collected by the ciliary action is passed not into the general cavity of the body, to be there retained, and the refuse to be ejected again from the mouth, as in the true polypes, but into a definite stomach, and passed through this along a complete tube, completely shut off from the general cavity of the animal, which contains the nutritive fluid, and is bounded by the hard cell wall. Thus we have, as in all the higher animals, a tube within a tube, and a distinction and division between the raw material of nutriment and the changed and elaborated product of digestion; and this distinction is

rightly considered to be of high physiological importance, and quite sufficient to determine that the Polyzoa belong to the great and distinguished sub-kingdom of the Mollusca, and may from henceforth cut their acquaintance, the humbler polype.

The cells which compose the outer skeleton of the Polyzoon are, of course, all for the protection of the animals. Whether they are tubular, as in the *Plumatella*, cup or cradle-shaped, as in the *Scrupocellaria*, or like pouches, as in many other forms, they always furnish retreats into which the whole animalcule, with its delicate tentacles, can be withdrawn. When so withdrawn, however, the animal has only retired within itself, for the cell, whether composed of chalky, horny, or gelatinous substance, is really the external wall of the creature, strengthened by, or consisting of, deposits of their substances. In order that the so-called head may be protruded or retracted from the cell at pleasure, it is, of course, necessary that some considerable part of the outer wall which joins it to the hard part of the same should be soft and flexible. A reference to the illustration of *Plumatella* will show the relation of the flexible to the hard part of the wall, and the muscles by which the head is pulled back. This illustration will also show the character of the alimentary canal, and how it is bent upon itself, so that the after part passes up close to the first descending portion. This arrangement of the food canal is very constant in the Polyzoa, and is dictated by the fact that, since the animal can only protrude one end of its body from the cell, both the entrance and the exit must be at that end. Muscles originating from



TUNICATA.—I. PEROPHORA LISTERI. II. SALPA MAXIMA (ONE OF A CHAIN TO SHOW CIRCULATION). III. DIAGRAM OF A SOLITARY TUNICATE. IV. TRANSVERSE SECTION OF SOLITARY TUNICATE. Refs. to Nos. in Figs.—I. 1, nervous ganglion; 2, atrial chamber and outlet; 3, respiratory pharynx with its slits; 4, stomach; 5, portion of heart; 6, growing bud. II. 1, front opening; 2, hind ditto; 3, 3, places of attachment to chain of salpæ; 4, respiratory band; 5, heart; 6, mass of viscera. III. 1, tentacles; 2, pharynx; 3, stomach; 4, anus; 5, oviduct; 6, anal opening; 7, oval opening. IV. 1, test, or tunic; 2, muscular coat; 3, third tunic; 4, the same reflected on the pharynx; 5, perforated pharynx; 6, endostyle; 7, anus.

the bottom of the hard part are attached to the stomach and throat, so as to pull these parts back when the head is withdrawn. In the re-entering angle between the mouth and arms a single ganglion is found, and this sends a few nerves round the throat and to the body walls, in some, at least, of these creatures. The reader will have gathered from the illustration and description that while some of these creatures have all the body-cavities of their simple zooids in communication with one another, others have these completely separate. In both cases, however, the simple animals seem, in many respects, dependent in some measure on the general structure. Thus many of them have external organs not possessed by each cell, but only by some of them, which organs, nevertheless, minister to the wants of all. These external organs are very singular, and are of two kinds. One kind is like a vibrating whip, and the other resembles the head and beak of a bird. Both are endowed with a power of motion which is apparently automatic. It is supposed that the whips constantly stir the water, so as to bring

fresh food within the action of the cilia, while the singular beaks snap up, kill, and hold any small creature till it decays, and so, by disintegration, furnishes food.

We have indicated the reasons for considering the Polyzoa superior to the Polypi, and before quitting them we ought to state in what respects they are inferior to the other Mollusca, so as to justify us in placing them lowest in the list. Their inferiority mainly consists in the want of a heart, and any true blood-vascular system, and also in not possessing a well-developed liver, which organs are constantly possessed by the other molluscs in great perfection. The liver in these creatures is only represented by some scattered brown-coloured glands placed on the outside of the stomach.

The *Tunicata* seem to be more nearly allied to the Polyzoa than the Brachiopoda, and therefore we treat of them next; although it seems to be also true that they are more closely related to the Conchifera than the Brachiopoda are. Perhaps the distinctness of the Brachiopoda as a class may be accounted for by the fact that they are a very ancient class of animals, having inhabited the earth from the earliest primary period. Many of the Tunicata, like the Polyzoa, are compound animals. They are, however, not exclusively so, and they are usually of a much larger size. They do not deposit any chalk or shell in their outer mantle. They have a heart with a single chamber, and a singular respiratory apparatus.

We will commence by the description of a simple animal, such as may be found adhering to the under side of a rock near low-water mark. The outer form is that of an Eastern leathern bottle, with a prominent mouth at one end; but it is unlike this bottle in that it has another opening on the side a little below the mouth. The mouth leads into a wide, dilated throat, which occupies a large part of the centre of the bag-like animal, and is of a very peculiar structure. It has in its walls a series of slits which lead into a cavity directly communicating with the lower orifice. The slits are very numerous and small, and their edges are fringed with cilia which continually drive the water from the central throat to the atrial chamber, as the cavity is called. At the top of the throat is a circle of tentacles which protrude into it, while at the bottom is an opening leading by a short oesophagus into a stomach, from which an intestine, twisted a few times, leads into the atrial chamber near its orifice. The remainder of the viscera, consisting of liver, heart, etc., are closely united with the stomach at the bottom part of the sac. From one end of the heart a vessel runs off, and is continued as a capacious channel along one side of the sac-like throat, while another channel along the opposite side runs to the viscera, and through them to the other end of the heart. The two channels above-mentioned communicate with one another by many transverse vessels, which branch in the membranous walls of the sac. Let us now consider the relation of these organs to the functions of respiration and alimentation. First, with regard to respiration. The cilia which fringe the slits are the prime movers of the water by driving it from the inner sac into the chamber which surrounds it. This motion necessitates that a current should set in at the mouth, or end opening, and another out at the anal or side opening, and thus fresh water is constantly brought to the inner, or what may now be called the respiratory sac. In the substance of this sac the blood is constantly changed by the motive power of the heart, which, though a simple tubular organ, contracts at one end first, and by the successive contraction of its circular fibres drives the blood to one of the channels, and from thence through the tissue of the sac into the other, and so, by way of the viscera, into its other end. It is peculiar to these animals that the current is occasionally reversed. After working in one direction for some time the heart remains at rest, and then begins to propel the blood in the other direction. Next, in relation to food, it will be seen that the current will bring with it many of those little creatures which are so numerous in the waters of the sea. By some mysterious action the cilia do not allow these particles of food to pass out by the slits, but propel them down towards the entrance to the stomach, and so onward. The excrement is, of course, passed out at the anal opening by the current. When any obnoxious substance is introduced by the current of water, it is felt by the tentacles which hang down inside the throat, and when this is the case the animal contracts the outer muscular coat so forcibly as to compress not only the atrial chamber, but also the respiratory

sac, and so drives the water and the substance out again. This action has procured for the simple tunicate the name of the Sea Squirt.

Compound Tunicates do not differ much in structure from the simple ones, but they are connected together in some instances by a stalk, through which the blood is driven from zooid to zooid. This is the case in the family of the Clavellinidae. In the family called Botryllidae the separate zooids are only the products of a budding process, and though they are at first connected organically and always cohere, yet when mature the vascular connection is obliterated, and each feeds and respire for itself. In another family a multitude of zooids are united in a tube, one end of which is closed and the other open. All the mouths, or in-current orifices, of these are outside the tube, and all the ex-current orifices inside, so that the current of water which passes into the tube, being compelled to pass out at one end, drives the whole animal along; these creatures differing from the foregoing families in being free and locomotive. Another free and locomotive family is characterised by what is called an alternation of generations. In these a solitary individual gives birth by budding to a whole chain of zooids unlike itself, and united to one another end to end, not, indeed, organically, but by simple attachment. These have their in-current orifices at one end, with a valve attached to them, so as to prevent the water escaping outward. When, therefore, the body is contracted the water is driven out at the other end, and so contributes to the onward motion of the chain. Across the respiratory sac there is a band or ribbon stretched, and this is the main instrument of respiration. One of these creatures (i.e., one link of the chain) is represented in the engraving. Each zooid, or link, gives birth to one solitary form, unlike itself but like its mother, and so the so-called alternation of generations is completed. The production of the solitary Salpa is a true reproductive process corresponding to the rearing of a plant from seed, but the production of the chain is analogous to the growth of a branch from a leaf-bud.

LESSONS IN GEOGRAPHY.—XXXII.

CONSTRUCTION OF PROJECTION OF MAP OF ASIA.

The method to be adopted by the learner in preparing a projection for a map of Asia is precisely the same in every respect as that laid down in Lessons in Geography, XXV. (Vol. II., page 355), with the exception of the position of the point from which the arcs representing the parallels of latitude are described; which, however, is determined in a similar manner to that adopted for finding the centre from which to describe the arcs representing the parallels of latitude of a map of Europe.

A base line must first be drawn, as *CD* in Fig. 17 (Vol. II., page 356). This line must be bisected in *E*, and through *E* a straight line *AB* must be drawn, which will represent the central meridian line of the map. It will be convenient to number this line as the 85th meridian east from Greenwich. Now take any space to represent ten degrees, but be careful that the space thus assumed is not taken too long in proportion to the base line of the map, and set off from *E*, the point of intersection of the base line *CD*, and the perpendicular *AB*, fifteen of these spaces, and number the points, beginning with *E*, 5, 10, 15, 20, 25, 30, 35, 40, 45, 50, 55, 60, 65, 70, 75, 80, and through the point numbered 80 draw the straight line *GH* parallel to *CD*. The figure of a projection of a map of Asia, it should be said, is not given here, as the method of constructing it will be made sufficiently clear to the learner by directing his attention to the lettering of Fig. 17, to which reference has been already made above. Now, as in the projection of the map of Europe, the straight line *GH* will be the limit of the map towards the top, and the points numbered upwards in succession from *E* will be the points through which will pass the parallels of latitude corresponding with the numbers. To find the centre from which to draw the arcs representing the parallels of latitude, set off five spaces more, of five degrees each, and bisect the last space thus set off. The point of bisection of the last space thus obtained will be distant $12^{\circ} 30'$ from the point representing the pole, and which would be numbered 90, continuing the numbering from 80 upwards. This will determine the point from which the arcs representing the parallel of latitude may be described through the points numbered 5, 10, 15, 20, etc., sufficiently near

for all practical purposes; although it should be stated that the distance of the common centre of these arcs from the pole is $12^{\circ} 8'$, instead of $12^{\circ} 30'$, to speak with greater accuracy, since the first named of these points—namely, that which is distant $12^{\circ} 8'$ from the pole, or the point numbered 90—is that at which a straight line, drawn through the points 25 and 60 in Fig. 14 (Vol. II., page 356), would cut the straight line *CE*, if it were produced far enough towards *E*.

As the method of forming a conical projection, or a projection in which the surface of a right cone is supposed to enter and come out from the spherical surface of a sphere in two circles, the planes of which are at right angles to the common axis of the cone and the sphere, has been described at length in Lessons in Geography, XXV. (Vol. II., page 355), it will be unnecessary to repeat it here. It will be sufficient, therefore, to remind the learner that, as we suppose the cone on which the map of Asia is to be projected to enter the sphere at the 25th and 60th parallels, these parallels being equidistant, supposing the globe to be a perfect sphere, from the points numbered 5 and 80, through which the lines limiting the map at top and bottom are drawn, the conical and spherical surfaces correspond at these parallels, and at these parallels the degrees of longitude, or rather the distances between the meridians, will possess their correct proportions; that is to say, that along the 25th parallel the distance between two meridians measuring a degree apart will be 54.38 geographical miles, while along the 60th parallel it will be 30 geographical miles, as may be seen by referring to the table at the end of Lessons in Geography, XXV. (Vol. II., page 357).

To determine the length of either of these spaces in the necessary proportions to the line that may have been assumed to represent five degrees, a diagonal scale of proportional parts, similar to those shown in Figs. 15, 16 (Vol. II., page 356), must be constructed. Spaces equivalent to 54.38 geographical miles may then be set off along the 25th parallel, on either side of the central meridian that was drawn perpendicular to the base line, and straight lines drawn through the points thus obtained from the common centre of the arcs that represent the parallels of latitude. The straight lines thus drawn will represent the meridians 80, 75, 60, etc., and 90, 95, 100, etc., all east from Greenwich, numbering to the right and left from the central meridian, which is numbered 85. The border lines of the map, the scale of miles, and the subdivision of the spaces between the meridians and parallels of longitude and latitude, may then be completed according to the directions given for constructing the projection of a map of Europe in the lesson that has been already named.

The following table will afford sufficient names for the construction of a map of Asia on a small scale. If a large scale be adopted, the latitudes and longitudes of additional places may be obtained from the index of places appended to any ordinary atlas.

TABLE OF LATITUDES AND LONGITUDES OF PLACES IN ASIA.

Names of Places.	Countries, etc.	Latitudes.	Longitudes.
Acheen, or Achin . . .	Sumatra (I.) . . .	$5^{\circ} 36' N.$	$95^{\circ} 25' E.$
Acro . . .	Syria . . .	32 55	35 4
Aden . . .	Arabia . . .	12 52	45 5
Agra . . .	Hindustan . . .	27 10	77 55
Ajmeer . . .	Hindustan . . .	26 28	74 37
Aleppo, or Halep . . .	Syria . . .	36 14	37 9
Amarapura . . .	Burmah . . .	21 55	93 7
Amoy . . .	Moluccas . . .	3 45 S.	123 15
Amoy . . .	China . . .	24 30 N.	113 7
Andaman (Is.) . . .	B. of Bengal . . .	12 0	93 0
Arcot . . .	Hindustan . . .	12 52	79 21
Ava . . .	Burmah . . .	21 47	95 58
Bagdad . . .	Mesopotamia . . .	33 21	44 28
Banca (I.) . . .	Sunda (Is.) . . .	2 30 S.	105 35
Banda (Is.) . . .	Oceania . . .	4 35	130 0
Bangalore . . .	Hindustan . . .	12 57 N.	77 35
Bangkok . . .	Siam . . .	13 38	100 27
Bassorah, or Basra . . .	Turkey in Asia . . .	30 31	47 53
Batavia . . .	Java . . .	6 22 S.	103 40
Benccoolen . . .	Sumatra . . .	3 50	102 2

Names of Places.	Countries, etc.	Latitudes.	Longitudes.
Bokhara . . .	Turkestan . . .	$39^{\circ} 33' N.$	$65^{\circ} 10' E.$
Bombay . . .	Hindustan . . .	18 57	72 51
Borneo . . .	Borneo (I.) . . .	5 2	114 52
Bushire . . .	Persia . . .	29 0	50 53
Cabool . . .	Afghanistan . . .	34 53	69 0
Calcutta . . .	Hindustan . . .	22 36	88 23
Calicut . . .	Hindustan . . .	11 12	75 48
Cambay . . .	Hindustan . . .	22 18	72 32
Cambodia . . .	Further India . . .	11 23	114 29
Canton . . .	China . . .	23 12	113 17
Cashgar . . .	Chinese Tartary . . .	39 20	74 4
Cashmere . . .	Hindustan . . .	34 6	74 55
Cawnpore . . .	Hindustan . . .	26 28	80 19
Chusan (I.) . . .	China . . .	30 3	122 6
Cochin . . .	Hindustan . . .	9 56	76 15
Colombo . . .	Ceylon . . .	6 55	79 53
Comorin (C.) . . .	Hindustan . . .	8 4	77 33
Damascus . . .	Syria . . .	33 31	36 14
Delhi . . .	Hindustan . . .	28 37	77 12
Diabekir . . .	Turkey in Asia . . .	37 56	40 9
Erzeroum . . .	Turkey in Asia . . .	39 57	41 19
Foo-chow . . .	China . . .	26 7	119 18
Formosa (I.) . . .	China . . .	23 30	121 0
George Town . . .	Prince of Wales I. . .	5 18	100 4
Ghizni, or Ghuznee . . .	Afghanistan . . .	33 34	68 17
Gilolo (I.) . . .	Moluccas . . .	1 0	128 0
Goa . . .	Hindustan . . .	15 27	73 53
Hainan (I.) . . .	China . . .	19 0	109 45
Hakodadi . . .	Japan (Is.) . . .	41 47	140 51
Herat . . .	Afghanistan . . .	34 26	62 8
Hio-go . . .	Japan (Is.) . . .	34 48	135 14
Hue . . .	Anam . . .	16 24	107 32
Hyderabad . . .	Hindustan . . .	25 24	68 18
Irkutsk . . .	Russia in Asia . . .	52 20	104 6
Ispahan . . .	Persia . . .	32 41	51 42
Jaffa . . .	Palestine . . .	32 2	34 47
Jeddo, or Yedo . . .	Japan (I.) . . .	35 43	139 43
Jerusalem . . .	Palestine . . .	31 47	35 15
Jidda . . .	Arabia . . .	21 30	39 22
Kanagawa . . .	Japan (I.) . . .	35 29	139 42
Kars . . .	Russian Armenia . . .	40 36	43 9
Kelat . . .	Beloochistan . . .	28 54	66 32
Kingitao . . .	Corea, China . . .	37 26	126 58
Kirghiz Steppes . . .	Russia in Asia . . .	48 30	48 30
Krio (C.) . . .	Turkey in Asia . . .	36 40	27 22
Labuan (I.) . . .	Borneo . . .	5 25	115 18
Laccadive (I.) . . .	Indian Ocean . . .	11 20	72 30
Ladrona (I.) . . .	Oceania . . .	17 0	146 0
Lahore . . .	Hindustan . . .	31 33	74 16
Lanchang . . .	Laos States . . .	15 0	105 0
Lassa . . .	Thibet . . .	30 48	91 25
Lucknow . . .	Hindustan . . .	26 51	80 56
Macao . . .	China . . .	22 15	113 36
Maecassar . . .	Celebes (I.), Oceania . . .	5 20 S.	119 28
Madras . . .	Hindustan . . .	13 5 N.	80 17
Malacca . . .	Further India . . .	2 14	102 13
Maldiva (Is.) . . .	Indian Ocean . . .	5 0	73 30
Mangalore . . .	Hindustan . . .	12 52	74 50
Manilla . . .	Philippine Is. . .	14 53	120 52
Martaban . . .	Further India . . .	16 31	96 59
Masulipatam . . .	Hindustan . . .	16 10	81 10
Mecca . . .	Arabia . . .	21 21	40 11
Medina . . .	Arabia . . .	24 58	39 58
Mocha . . .	Arabia . . .	13 10	43 20
Muscate . . .	Arabia . . .	23 29	58 33
Nagasaki . . .	Japan (Is.) . . .	32 48	129 57
Nankin . . .	China . . .	32 3	118 53
Napa . . .	Lo-o-Choo (Is.) . . .	26 14	127 46
Negata . . .	Japan (Is.) . . .	37 58	139 22
Nicobar (I.) . . .	B. of Bengal . . .	8 0	93 0
Ningpo . . .	China . . .	29 42	121 21
North Cape . . .	Russia in Asia . . .	69 0	179 10W.
Okhotsk . . .	Russia in Asia . . .	59 23	143 7 E.
Orenburg . . .	Russia in Asia . . .	49 43	63 40
Ormuz (I.) . . .	Persia . . .	27 3	56 26
Osaka . . .	Japan (I.) . . .	34 44	145 25
Padang . . .	Sumatra . . .	0 52 S.	100 24
Palmyra . . .	Syria . . .	34 18 N.	38 34
Peking . . .	China . . .	39 53	116 29
Pelew (I.) . . .	Further India . . .	16 20	97 20
Petropaulovski . . .	Russia in Asia . . .	53 10	153 32
Pondicherry . . .	Hindustan . . .	11 56	79 48

Name of Place.	Country, etc.	Latitude.	Longitude.
Quilon . . .	Hindustan . . .	8° 55' N.	76° 37' E.
Rangoon . . .	Further India . . .	16 53	96 4
Ruttunpoor . . .	Hindustan . . .	22 14	82 3
Saigon . . .	Cochin-China . . .	10 33	106 33
Samarcand . . .	Turkestan . . .	39 49	67 18
Sarawak . . .	Borneo . . .	1 28	110 8
Semipolatsk . . .	Russia in Asia . . .	50 33	80 6
Seringapatam . . .	Hindustan . . .	12 24	76 41
Shanghai . . .	China . . .	31 13	121 27
Shantung (C.) . . .	China . . .	37 26	122 43
Shiraz . . .	Persia . . .	29 39	52 40
Singapore . . .	Further India . . .	1 15	103 51
Sinope . . .	Asia Minor . . .	42 1	35 7
Smyrna . . .	Asia Minor . . .	38 26	27 7
Surat . . .	Hindustan . . .	21 10	72 32
Tarsus . . .	Asia Minor . . .	36 54	34 43
Teflis . . .	Transcaucasia . . .	41 37	45 3
Teheran . . .	Persia . . .	35 44	51 25
Tellicherry . . .	Hindustan . . .	11 46	75 32
Tenasserim . . .	Further India . . .	12 2	98 55
Termete (I.) . . .	Philippine (Is.) . . .	1 15	127 45
Tobolsk . . .	Russia in Asia . . .	58 20	67 28
Tomsk . . .	Russia in Asia . . .	56 31	85 0
Tonquin . . .	Anam . . .	21 10	104 30
Tonquebar . . .	Hindustan . . .	11 1	79 51
Trebizond . . .	Turkey in Asia . . .	41 0	39 45
Trincomalee . . .	Ceylon (I.) . . .	8 34	81 12
Tripoli . . .	Syria . . .	34 24	35 48
Tyre . . .	Palestine . . .	33 17	35 17
Victoria . . .	Hong-Kong, China . . .	22 14	114 13
Vizagapatam . . .	Hindustan . . .	17 41	83 19
Yakutsk . . .	Russia in Asia . . .	61 53	129 30
Yeniseisk . . .	Russia in Asia . . .	58 12	92 25

LESSONS IN ARITHMETIC.—XLIII.

SCALES OF NOTATION—DUODECIMALS—SQUARE AND CUBIC MEASURE.

1. In the common or decimal notation, as we have seen, the value of the figures representing any number increases from right to left, by powers of ten.

Thus, 5638 means $5 \times 10^3 + 6 \times 10^2 + 3 \times 10 + 8$.

Now although this employment of 10 as the radix, as it is called, of our Scale of Notation, is convenient, it is quite arbitrary; and we might express any number by means of powers of any other number than 10.

For instance, if 4 were taken as the radix of the scale of notation, 231 would denote $2 \times 4^2 + 3 \times 4 + 1$.

Similarly, if 8 were the radix of the scale, 5732 would mean $5 \times 8^3 + 7 \times 8^2 + 3 \times 8 + 2$.

The numbers here represented by 231 and 5732 are said to be expressed in the scale of 4 and the scale of 8 respectively.

2. It is evident that each of the figures or digits which occur in any scale must be less than the radix of the scale. Thus, in the scale of 4, the largest digit or figure which can occur is 3; in that of 8, 7; and similarly for other scales. For suppose 8 to occur in the scale of 8, its effect would be to increase by 1 that power of 8 which it multiplied; and this would be the same thing as increasing the digit immediately on its left by 1.

Suppose we take 12 for the radix of the scale, we must then have symbols to represent the numbers 10 and 11. If we use t and e respectively for them, then such a number as the following, 574e9, would mean—

$$5 \times 12^5 + 7 \times 12^4 + 10 \times 12^3 + 4 \times 12^2 + 11 \times 12 + 9.$$

The scale of which the radix is 12 is called the *duodecimal* or *duodenary* scale.

We do not mean here to go at length into the various propositions connected with scales of notation, for they belong properly to algebra, and cannot be satisfactorily explained without its aid. We subjoin, however, one or two propositions, which will be useful in giving the student a clearer insight into the principles of arithmetical notation.

3. A number being given in the Decimal Scale, to express it in the Duodecimal Scale.

EXAMPLE.—Express 56789 in the duodecimal scale. Divide successively by 12, as below.

$$\begin{array}{r} 12 \overline{) 56789} \\ 12 \overline{) 4732} \dots 5 \text{ units over.} \\ 12 \overline{) 394} \dots 4 \text{ times } 12 \text{ over.} \\ 12 \overline{) 32} \dots 10 \text{ times } 12^2 \text{ over.} \\ \dots 2 \dots 8 \text{ times } 12^3 \text{ over.} \end{array}$$

The first division shows that

$$56789 = 4732 \times 12 + 5.$$

The second, that

$$4732 = 394 \times 12 + 4.$$

That is,

$$56789 = 394 \times 12^2 + 4 \times 12 + 5.$$

Similarly, the third division shows that

$$56789 = 32 \times 12^3 + 10 \times 12^2 + 4 \times 12 + 5.$$

And the last, that

$$56789 = 2 \times 12^4 + 8 \times 12^3 + 10 \times 12^2 + 4 \times 12 + 5.$$

So that, in the duodecimal scale, 56789 would be written

$$28t45.$$

The above process, which manifestly would apply to any scale, will sufficiently explain the following

Rule for Reducing a Number given in the Decimal Scale to any other Scale.

Divide the given number by the radix of the scale, putting down the remainder; divide the quotient again by the radix, and so on, until the quotient is less than the radix, so that the division is no longer possible. The last quotient and the successive remainders, written down in order from left to right, will be the correct notation for the number in the required scale.

4. Given any number expressed in the Duodecimal Scale, to reduce it to its equivalent expression in the Decimal Scale.

This can evidently be done by dividing successively by 10, taking care to recollect what the value of each figure in the dividend really is.

EXAMPLE.—Express 28t45 in the decimal scale.

$$\begin{array}{r} 10 \overline{) 28t45} \\ 10 \overline{) 3352} \dots 9 \\ 10 \overline{) 3e3} \dots 8 \\ 10 \overline{) 48} \dots 7 \\ \dots 5 \dots 6 \end{array}$$

The answer therefore is 56789.

The division is performed as follows:—

Ten in 23 (duodecimal scale) is really 10 in $2 \times 12 + 8$, or 32, which gives 3 and 2 over.

Ten in 2t is really 10 in $2 \times 12 + 10$, or 34, which gives 3 and 4 over.

Ten in 4t is really 10 in $4 \times 12 + 4$, or 52, which gives 5 and 2 over.

Ten in 25 is really 10 in $2 \times 12 + 5$, or 29, which gives 2 and 9 over.

And similarly for the other lines.

This operation has proved to us that

$$2 \times 12^4 + 8 \times 12^3 + 10 \times 12^2 + 4 \times 12 + 5 = 5 \times 10^4 + 6 \times 10^3 + 7 \times 10^2 + 8 \times 10 + 9.$$

5. Similarly, a number expressed in any scale whatever can be transformed to any other scale, by successively dividing by the radix of the scale into which it is to be transformed.

We content ourselves with giving an example, with its explanation.

EXAMPLE.—Given 56435, expressed in the scale of 8, to reduce it to the scale of 6.

$$\begin{array}{r} 6 \overline{) 56435} \\ 6 \overline{) 7604} \dots 5 \\ 6 \overline{) 1220} \dots 0 \\ 6 \overline{) 156} \dots 2 \\ 6 \overline{) 22} \dots 2 \\ 6 \overline{) 3} \dots 0 \end{array}$$

302205.—Answer.

The division is performed as follows:—

Six in 56 (in the scale of 8) is six in $5 \times 8 + 3$, or 46, that is, 7 and 4 over. Six in 44 (in the scale of 8) is six in $4 \times 8 + 4$, or 36, that is, 6 and 0 over. Six in 3 is 0 and 3 over.

Six in 35 (in the scale of 8) is six in $3 \times 8 + 5$, or 29, that is, 4 and 5 over. And similarly for the other lines.

This operation, in fact, proves that

$$5 \times 8^4 + 6 \times 8^3 + 4 \times 8^2 + 3 \times 8 + 5 = 3 \times 6^4 + 0 \times 6^3 + 2 \times 6^2 + 2 \times 6 + 0 \times 6 + 5.$$

6. One application of the duodecimal scale is very useful in ordinary practice.

In finding areas and cubical contents, as we showed (Lesson XVIII, Arts. 7 and 8, Vol. I., page 292), we have to multiply the numbers indicating the dimensions together. Now, since 1 foot is 12 inches, any dimension given in feet and inches can be at once written down in the duodecimal scale. Thus, 5 feet 9 inches would be written 5'9, putting a point after the 5 to express that the 9 is $\frac{9}{12}$ of the unit, for the same reason that, in the decimal notation, we place a decimal point before the tenths' place.

Now suppose we have to find the dimensions of a board, the length of which is 5 feet 9 inches, and breadth 4 feet 5 inches, we should have to multiply 5'9 by 4'5 in the duodecimal scale.

This would be done as follows:—

$$\begin{array}{r} 5'9 \\ 4'5 \\ \hline 24'9 \\ 1'0 \\ \hline 21'49 \end{array}$$

We say 5 times 9 are 45; that is, $3 \times 12 + 9$. Write down the 9, and carry 3. 5 times 5 are 25, and 3 are 28, which is $2 \times 12 + 4$, and we therefore write down 24.

Again, 4 times 9 are 36; that is, 3×12 , or in the duodecimal scale, 30. Write down the cipher, and carry the 3. 4 times 5 are 20, and 3 are 23, which is $1 \times 12 + 11$, or, in the duodecimal scale, 1e, which we write down.

Adding, we get 9; 4; e and 2 are 13; that is, $1 \times 12 + 1$. Write down 1 and carry 1; 1 and 1 make 2.

The result, therefore, is 21'49 in the duodecimal scale.

Now, 21 is $2 \times 12 + 1$, or 25 in the decimal scale; and 49 is $4 \times 12 + 9$, or 57 in the decimal scale.

Hence, the answer is 25 sq. feet 57 sq. inches.

7. We can verify the process by fractions:—

$$\begin{array}{l} 5 \text{ ft. } 9 \text{ in.} = 5\frac{3}{4} \text{ ft.} \\ 4 \text{ ft. } 5 \text{ in.} = 4\frac{5}{12} \text{ ft.} \end{array}$$

Hence the area of the board = $5\frac{3}{4} \times 4\frac{5}{12}$ sq. ft. = $21\frac{49}{12}$ sq. ft.

$$48 \overline{) 1219} \text{ (25 sq. ft. 57 sq. in.)}$$

$$\begin{array}{r} 96 \\ 259 \\ 240 \\ \hline 19 \\ 144 \\ \hline 48 \overline{) 2736} \\ 240 \\ \hline 336 \\ 336 \\ \hline \dots \end{array}$$

N.B. It will assist the learner, in multiplying, adding, etc., in the duodecimal scale, to recollect that it is exactly the same process as multiplying and adding pence, and reducing them to shillings. Thus, in the above example, we might say:

5 nines are 45, that is, 3, and 9 pence; 5 fives are 25 and 3 are 28, that is, 2 and 4 pence. And so on.

8. EXAMPLE 2.—Find the cubical contents of a room which is 25 ft. 9 in. long, 14 ft. 4 in. broad, and 16 ft. 4 in. high.

25 ft. 9 in. = 21'9 in the duodecimal scale.

14 ft. 4 in. = 12'4 " " "

16 ft. 4 in. = 14'4 " " "

$$\begin{array}{r} 21'9 \\ 12'4 \\ \hline 379 \\ 436 \\ 219 \\ \hline 269'10 \\ 24'4 \\ \hline t3040 \\ t3040 \\ 26910 \end{array}$$

$$354'440 = 6025 \text{ cub. ft. } 624 \text{ cub. in.}$$

The same Example worked by fractions.

The contents in cubic feet is—

$$25\frac{3}{4} \times 14\frac{1}{3} \times 16\frac{1}{3} = 12\frac{1}{2} \times 4\frac{1}{2} \times 21\frac{1}{2} = 1122\frac{1}{2}.$$

$$36 \overline{) 217021} \text{ (6028 cub. ft. } 216 \text{ in.)}$$

$$\begin{array}{r} 102 \\ 72 \\ \hline 301 \\ 288 \\ \hline \dots \end{array}$$

$$13 \times 1728 = 22464$$

Ans.—6025 cub. ft., 624 cub. in.

$$36 \overline{) 22464} \text{ (624 cub. in. } 216 \text{ in.)}$$

$$\begin{array}{r} 86 \\ 72 \\ \hline 144 \\ 144 \\ \hline \dots \end{array}$$

KEY TO EXERCISES IN LESSONS IN ARITHMETIC.—XLII.

EXERCISE 62.

- | | | |
|---|--|--|
| 1. £9 12s. 3 $\frac{1}{2}$ d. | 19. 89 $\frac{1}{2}$ grains. | 31. 15463 grs. approximately. |
| 2. 5306 farthings. | 20. 231'973. | 32. 1 $\frac{1}{2}$. |
| 3. £4 19s. | 21. 3s. 2 $\frac{1}{2}$ d. | 33. 1 $\frac{1}{2}$. |
| 4. 9 days. | 22. 46 taels 1 mace 2 candrs. 5 cash. | 34. 126'295 sovereigns. |
| 5. 68 $\frac{1}{2}$ lbs. | 23. 391 lbs. 11 oz. 7'296 drams. | 35. 6 thalers 29 gros, nearly. |
| 6. £2926. | 24. 25 fr. 50 cents, nearly. | 36. 9 florins 52 kreutz, nearly. |
| 7. £36 19s. 2 $\frac{1}{2}$ d., or 4 $\frac{1}{2}$ s. per yard. | 25. £78 18s. 9 $\frac{1}{2}$ d. | 37. 11'423 florins. |
| 8. £76 10s. 1d. | 26. 146 thalers 9 $\frac{1}{2}$ groschen. | 38. 2 $\frac{1}{2}$ francs. |
| 9. French metre is 3'2204 Rhenish feet. | 27. 13423 francs 41 centimes. | 39. 16 marks 3 schills, nearly. |
| 10. 1800 lbs. | 28. 939 florins 87 $\frac{1}{2}$ kreutzers (100 for (36) (37) (38) (40) is 1 $\frac{1}{2}$ %, and for (39) $\frac{1}{2}$ %). | 40. The fixed number for (36) (37) (38) (40) is 1 $\frac{1}{2}$ %, and for (39) $\frac{1}{2}$ %. |
| 11. 341 $\frac{1}{2}$ chaldrons. | 29. 1127 florins 85'12 kreutzers. | 41. 25 fr. 63 cents, nearly. |
| 12. 2306 $\frac{1}{2}$ qrs. | 30. 4'4 $\frac{1}{2}$ shillings. | 42. 4 reis 50 mil-reis, nearly. |
| 13. 836 $\frac{1}{2}$ yds. | 43. 4'29 mil-reis. | 43. 4'29 mil-reis. |
| 14. 285 cwt. 2 qrs. 24 lbs. | | |
| 15. 388 dishes 53 $\frac{1}{2}$ lbs. | | |
| 16. £14. | | |
| 17. 818 $\frac{1}{2}$. | | |
| 18. £149 11s. 9 $\frac{1}{2}$ d. | | |
| 44. The number of pence received for a dollar in each of the five cases given is— | | |
| (*) 46 $\frac{1}{2}$. | (*) 43 $\frac{1}{2}$. | (*) 46 $\frac{1}{2}$. |
| (*) 47 $\frac{1}{2}$. | (*) 46 $\frac{1}{2}$. | (*) 46 $\frac{1}{2}$. |

Hence the 4th way is the most advantageous.

45. About 11 francs 82 cents. per oz. dearer in Paris.

LESSONS IN FRENCH.—XLVI.

SECTION CII—EXAMPLES ILLUSTRATING THE VARIOUS USES OF THE PRINCIPAL CONJUNCTIONS.

À MOINS QUE.

Il n'en fera rien, à moins que vous ne lui parliez.	He will do nothing of the kind, unless you speak to him.
À moins que vous ne preniez bien votre temps, vous n'en viendrez pas à bout.	Unless you choose your time well, you will not accomplish it.
Quel indigne plaisir peut avoir l'avarice?	What unworthy pleasure can avarice offer?
Et que sert d'amasser, à moins qu'on en jouisse?	What is the use of hoarding up unless we enjoy?

BOURSAULT.

AUSSI.

Aussi ils n'ont aucune force pour le posséder sûrement.	Therefore, they have no strength to possess it safely.
PASCAL.	
Ma douleur serait trop médiocre, si je pouvais la dépeindre; aussi je ne l'entreprendrai pas.	My grief would be too trifling if I could depict it; so that I will not undertake it.

MISE. DE SÉVIGNÉ.

AU RESTE.

C'est ce qu'il y a de plus sage; au reste, c'est aussi de qu'il y a de plus juste.	This is the wisest way; besides, it is also the most just.
--	--

MARTEAU.

CAR.

Voilà les périls, voici le moyen de les éviter; car enfin, le bras de Dieu n'est pas raccourci.	Those are the dangers, this is the way of avoiding them; for finally, the influence of God is not less powerful.
---	--

MASSILLON.

Le peuple se figure une félicité imaginaire dans les situations élevées, où il ne peut atteindre, et il croit (car tel est l'homme) que tout ce qu'il ne peut avoir, c'est cela même qui est le bonheur qu'il cherche.

MASSILLON.

COMME—QUE.

Comme l'ambition n'a pas de frein, et que la soif des richesses nous consume tous, il en résulte, quo le bonheur nous fuit à mesure que nous le cherchons.

TH. CORNEILLE.

La reconnaissance est le plus doux, comme le plus saint des devoirs.

THOMAS.

Comme il sonna la charge, il sonne la retraite.

LA FONTAINE.

DONC.

Votre maître vous aime; donc, vous devez l'aimer.

Je suis donc un témoin de leur peu de puissance.

RACINE.

Et d'où peut donc venir ce changement extrême?

VOLTAIRE.

Si ce n'est toi, c'est donc ton frère.—Je n'en ai pas.—C'est donc quelqu'un des tiens.

LA FONTAINE.

Allons donc! répondit-on, et la transaction n'eut pas lieu.

DE CUSY.

DE MÊME QUE.

De même que le soleil brille sur la terre, de même le juste brillera dans les cieux.

L'ACADÉMIE.

ET.

C'est être faible et timide que d'être inaccessible et fier.

MASSILLON.

Une famille vertueuse est un vaisseau tenu pendant la tempête par deux ancres, la religion et les mœurs.

CHATEAUBRIAND.

Quel carnage de toutes parts! On égorge à la fois les enfants, les vieillards,

Et la sœur et le frère, Et la fille et la mère,

Les fils dans les bras de son père.

RACINE, "Esther."

LORSQUE—QUAND.

Lorsque l'innocence habitait la terre.

BOSSUET.

Quand vous me haïriez, je ne m'en plaindrais pas.

RACINE.

Quand nous n'aurions égard qu'au repos seul de notre vie, quand nous n'aurions point d'autre intérêt ici-bas que de nous préparer des jours heureux, quel bonheur de prévenir d'avance et d'étouffer dans leur naissance tant de passions violentes.

MASSILLON.

MAIS.

C'était déjà la puissance impériale qu'on lui a vue depuis, mais avec l'assentiment universel des peuples, avec des formes moins royales, mais plus dignes peut-être.

THIERS.

L'harmonie ne frappe pas simplement l'oreille, mais l'esprit.

BOILEAU.

C'est un parti sage à la guerre de se tenir sur la défensive, mais ce n'est pas le plus brillant.

LA ROCHEFOUCAULD.

The people picture to themselves an imaginary happiness in elevated situations which they cannot reach, and they believe (for such is man) that all that they cannot obtain, forms the very happiness which they seek.

As ambition has no limits, and as the thirst of riches devours us all, the result is, that happiness avoids us as we proceed in our search after it.

Gratitude is the sweetest as well as the holiest of duties.

As he sounded the charge, so he sounds the retreat.

Your master loves you; therefore you should love him.

I am, therefore, a witness of their want of power.

Whence, therefore, can this extreme change proceed?

If it is not you, then it is your brother.—I have none.—Then it must be some one of your family.

"Nonsense!" replied they, and the affair did not take place.

As the sun shines upon earth, so will the just shine in heaven.

To be inaccessible and proud is to be weak and timid.

A virtuous family is a vessel strengthened during the tempest by two anchors, religion and morals.

What carnage on all sides! They murder at once the children and the old men, the sister and the brother, the daughter and the mother, the son in the arms of his father.

When innocence inhabited the earth.

If even you hated me I would not complain.

If even we considered merely the repose of our lives, if even we had no other interest here than to prepare for ourselves happy days, what happiness it would be, to prevent beforehand, to stifle in their birth, so many violent passions.

It was already the imperial power of which we have since seen him possessed, but with the consent of the people, with forms less regal, but perhaps more dignified.

Harmony does not only strike the ear, but the mind.

To keep on the defensive is a wise course in war, but it is not the most brilliant.

Il n'y a point de mais qui tienna; je ne donnerai point ma fille à un muet.

BEUVEYS.

NI.

Heureux celui qui sait se contenter de peu! Son sommeil n'est troublé ni par les craintes, ni par les désirs honteux de l'avance.

TRAD. D'HORACE.

Vous perdez ainsi la confiance de vos amis, sans les avoir rendus ni meilleurs ni plus habiles.

VOLTAIRE.

On n'est jamais si heureux, ni si malheureux qu'on se l'imagine.

LA ROCHEFOUCAULD.

Cette loi sainte ne connaît plus ni pauvre, ni riche, ni noble, ni roturier, ni maître, ni esclave.

MASSILLON.

OR.

Or sus, mettons-nous à l'ouvrage.

Or ça, Gil Blas, me dit-il un jour, le temps de ton enfance est passé.

LE SAGE.

OU.

La fortune, soit bonne ou mauvaise, soit passagère ou constante, ne peut rien sur l'âme du sage.

MARMONTEL.

La liberté de publier ses pensées, ou la liberté de la presse, doit être réglée sur la liberté même d'agir.

B. DE ST. PIERRE.

PARCE QUE.

Les grands hommes entreprennent de grandes choses parce qu'elles sont grandes, et les fous parce qu'ils les croient faciles.

VAUVENARGUES.

Là tout est beau, parce que tout est vrai.

J. J. ROUSSEAU.

POURTANT.

Le style le moins noble a pourtant sa noblesse.

BOILEAU.

PUISQUE.

Pourquoi le demander, puisque vous le savez?

RACINE.

Ne vous laissez jamais d'examiner les causes des grands changements; puisque rien ne servira jamais tant à votre instruction.

BOSSUET.

Puisque vous le voulez, je vais changer de style.

BOILEAU.

QUE.

Jamais on ne vit un si grand exemple, que le courage n'est point incompatible avec la mollesse.

VOLTAIRE.

Nous n'avons que peu de temps à vivre, et loin d'en profiter, nous ne cherchons qu'à le perdre.

LAVEAUX.

A quoi vous servira d'avoir de l'esprit, si vous ne l'employez pas, et que vous ne vous appliquez pas?

BOSSUET.

Toutefois, que sert-il de me justifier?

RACINE.

Qu'il fasse ce qu'il lui plaira, que le monde est grand! Qu'il est magnifique!

MASSILLON.

Que de beaux jours n'ont pas de beaux soirs!

BOISTE.

Sais-tu quelque chose de plus?

BEUVEYS.

Oh! que oui.

BEUVEYS.

C'est une maladie d'esprit, que de souhaiter des choses impossibles.

FENELON.

There is no "but" in the matter; I will not give my daughter to a mute.

Happy is he who can content himself with little! His sleep is disturbed neither by the fear, nor the shameful desires of avarice.

You lose thus the confidence of your friends without having rendered them either better or more skilful.

We are never so happy nor so unhappy as we fancy.

That holy law knows no longer either poor or rich, noble or plebeian, master or slave.

Now, then, let us go to work.

"Now, then, Gil Blas," said he to me one day, "the time of your childhood is over."

Fortune, be it good or bad, be it transient or constant, has no power over the soul of the wise.

The liberty of publishing one's thoughts, or the liberty of the press, should be regulated upon the liberty of action itself.

Great men undertake great things because they are great; and fools because they believe them easy.

Everything there is beautiful, because everything is true.

The least elevated style has, nevertheless, its elevation.

Why ask about it, since you know it?

Never be weary of examining into the causes of great changes; for nothing will ever be of so much service to your instruction.

Since you will have it so; I will change my style.

Never was such a striking example seen, that courage is not incompatible with effeminacy.

We have but little time to live, and instead of improving it, we only seek to waste it.

Of what use will be your wit, if you do not employ it, and do not apply yourselves?

However, what is the use of justifying myself?

Let him do what he pleases.

How great is the world! How magnificent!

How many fine days have not beautiful evenings!

Do you know anything more?

That, I do.

Wishing for impossible things is a disease of the mind.

Il n'y aura jamais de meilleur directeur que l'Évangile.

GANGANELLI.

La véritable conversion du cœur fait autant aimer Dieu qu'on a aimé les créatures. PASCAL.

Crois-tu que dans son cœur, il ait juré ta mort? RACINE.

Ce n'est pas que j'eusse mieux fait que vous.

MME. DE SÉVIGNÉ.

Il a fallu que mes malheurs m'aient instruit, pour m'apprendre ce que je ne voulais pas croire. FÉNELON.

There will never be any better guide than the Gospel.

The true conversion of the heart makes us love God as much as we have loved the creatures.

Do you believe that he has sworn your death in his heart?

It is not that I might have done better than you.

It was necessary that my misfortunes should instruct me, to teach me what I would not believe.

QUOIQUE—QUOI . . QUE.

Quoique Dieu et la nature aient fait tous les hommes égaux en les formant d'une même boue, la vanité humaine ne peut souffrir cette égalité. BOSSUET.

Quoi que vous écriviez, évitez la bassesse. BOILEAU.

Quoi que ce soit qu'elle dise, elle ne me persuadera pas. GIRAULT-DUVIVIER.

Whatever you may write, avoid vulgarity.

Whatever she may say, she will not persuade me.

SI.

Si vous le vouliez, nous partirions ensemble.

Si vous le prenez sur ce ton, je me retire.

Nul empire n'est sûr, s'il n'a l'amour pour base. RACINE.

S'il le faut, nous partirons. Votre esprit a toujours en réserve quelque si, quelque mais. DESTOUCHES.

If you wished it, we would go together.

If you go on in this way, I withdraw.

No empire is safe, unless it has affection for its basis.

If it must be so, we will go. Your mind has always in reserve some "if," some "but."

SINON.

Us répondirent, qu'il fallait rétablir l'équilibre européen rompu, qu'il fallait le rétablir sinon sur le continent, où il était tout à fait détruit, au moins sur l'Océan. THIERS.

They replied, that it was necessary to re-establish the disturbed European balance; that it was necessary to restore it, if not on the continent, where it was entirely destroyed, at least on the ocean.

SOIT.

Soit qu'il le fasse, soit qu'il ne le fasse pas.

Soit la hardiesse de l'entreprise, soit la seule présence de ce grand homme, soit la protection visible du ciel, il étonne par sa résolution. FLÉCHIER.

Soit en bien, soit en mal, mon ami, la prudence dit, qu'il faut rarement juger sur l'apparence. CHÉRON.

Vous le voulez? ainsi soit-il!

Un mal funeste et contagieux se répandit dans les principales villes de la Normandie; soit que l'intempérie des saisons eût laissé dans les airs quelque maligne impression, soit qu'un commerce fatal eût apporté des pays éloignés, avec de fragiles richesses, des semences de maladie et de mort, soit que l'ange de Dieu eût étendu la main pour frapper cette malheureuse province. FLÉCHIER.

Whether he does it, whether he does it not.

Be it the boldness of the enterprise, be it the presence alone of this great man, be it the visible protection of heaven, he astonishes us by his resolution.

Be it for good, be it for evil, my friend, prudence says that we must rarely judge from appearances.

You will have it so? So be it!

A fatal and contagious disease spread in the principal cities of Normandy, be it that the inclemency of the season has left in the air some malignant impression, be it that a fatal commerce had brought from distant countries, with perishable riches, the seeds of disease and death, be it that the angel of God had stretched forth his hand to smite that unfortunate province.

KEY TO EXERCISES IN LESSONS IN FRENCH.

EXERCISE 137 (Vol. II., page 172).

1. Go and see my brother, he has something to communicate to you. 2. Run and tell them that I am waiting for them. 3. My brother has taken good care not to tear his clothes. 4. Has your cousin taken care not to stain her dress. 5. She took care not to fall, for in falling she would have spoiled it. 6. Have those little girls gone into mourning? 7. They have just put on mourning. 8. For whom do you put on mourning? 9. I wear mourning for my mother. 10.

Do you take tea or coffee in the morning? 11. We take tea and coffee. 12. Do you not take chocolate sometimes? 13. We take it only when we are sick. 14. What determination has the governor taken? 15. He has taken the resolution to remain silent. 16. Will you take my part or your son's? 17. I shall take yours, if I believe that you are right. 18. Why do you not take the trouble of reading his letter? 19. Because it is not worth reading (literally, the trouble, while). 20. Is not your courier gone on before? 21. He has not been able to go on before. 22. Are you not wrong to take his part? 23. I am not wrong to take it. 24. Have you taken your tea? 25. We have not taken our tea, we have taken our coffee.

EXERCISE 138 (Vol. II., page 172).

1. M. votre frère a-t-il pris garde de gâter son chapeau? 2. Il a pris garde de le gâter, il n'en a qu'un. 3. Allez parler à Mlle votre sœur, elle vous appelle. 4. Ne voulez-vous pas prendre une tasse de thé? 5. Je viens de prendre le thé. 6. Qu'avez-vous dit à votre petite fille? 7. Je lui ai dit de prendre garde de déchirer sa robe. 8. Prenons garde de déchirer ce livre. 9. Mon fils vient de l'apporter. 10. A-t-il pris le thé? 11. Il n'a pas encore pris le thé, il est trop tôt. 12. À quelle heure prenez-vous le thé chez vous? 13. Nous prenons le thé à six heures. 14. Prenez-vous du thé ou du café à votre déjeuner? 15. Nous prenons du café. 16. Votre courrier a-t-il pris les devants? 17. Il n'a pu prendre les devants. 18. Quel parti avez-vous pris? 19. J'ai pris le parti d'étudier ma leçon. 20. Avez-vous pris garde de déchirer vos livres? 21. J'ai pris garde de les tacher. 22. Quel parti votre frère a-t-il pris? 23. Il a pris le parti de se taire. 24. Avez-vous pris mon parti? 25. J'ai pris le parti de mon frère. 26. Avez-vous raison de prendre son parti? 27. J'ai raison de prendre son parti, parce qu'il a raison. 28. N'avez-vous pas peur de prendre son parti? 29. Je n'ai pas peur de prendre son parti. 30. Prendrez-vous le parti de votre sœur ou le mien? 31. Je prendrai le parti de ma sœur. 32. Allez lire votre livre, vous ne savez pas votre leçon. 33. Je sais ma leçon, et je sais aussi que vous êtes mon ami. 34. Allons trouver notre père, il a besoin de nous.

GEOMETRICAL PERSPECTIVE.—IX.

OUR previous lessons in Perspective have been upon the ground-plan method; we will now introduce to our pupils the lineal method—we call it the lineal because its results depend upon the projection of planes and angles without the intervention of a plan. It sometimes occurs that a perspective elevation of a house or other building is all that is required; in this case a plan would be useless, and the lineal method would be most convenient, as it saves the labour of making a plan for the sole purpose of raising an elevation from it.

The picture plane, the horizontal line, vanishing points, station point, line of contact, or measuring line for heights, and point of sight, are common to both methods; therefore we need not recapitulate our remarks upon them; that which will be especially new to our pupils is that the angle of inclination which an object makes with the picture plane is described, instead of drawing it in plan. Visual rays will not be required, as the retiring length of an object is cut off the vanishing line by the help of its distance point, marked *DP*. The nearest approach to this system which we have yet made is shown in Lesson IV., Vol. II., page 359. It is true we have there made use of a plan, but there are no visual rays (see Figs. 22, 26). The plan has been introduced solely for the purpose of obtaining by construction the positions of the extremities of the lines upon the picture plane. Let us take Fig. 23, and we shall here see that the position of the line *HI* in the picture is ascertained by finding the positions of the two extremities only. Thus the points *h* and *i* being determined as the perspective representations of *H* and *I*, the completion of the line follows by drawing a line between the two points. Now these positions can be given without the necessity of a plan, as we are about to explain.

We think we shall be able to make our explanations clearer, and better understood by our pupils, if we propose a problem at once, and during the process of drawing, accompany the explanations of the work with our observations upon the theory, at the same time employing the figure as we draw it to illustrate our remarks.

PROBLEM XXVII. (Fig. 49).—A pole 4 feet long is lying on the ground, and is inclined to the picture plane at an angle of 40° ; its nearest end is 2 feet within the picture, and 1 foot to the right of the eye; distance of the eye from the *PP* is 6 feet and 4 feet from the ground; scale 1 inch to the foot.

Draw the picture plane, *PP*, and the *HL* parallel with the *PP*

and 4 feet above it. Anywhere upon the HL mark the PS (point of sight). From PS as a centre, and with the distance of 6 feet in the compasses, draw the semicircle DE^1 , DE^2 . Before we go any farther we will examine this. To assist in understanding the position and meaning of this semicircle we refer back to Fig. 21, Lesson IV., Vol. II., page 360. There it will be seen that E represents the eye, and its distance from the PP from E to PS. Of course PS is opposite the eye E, and a line

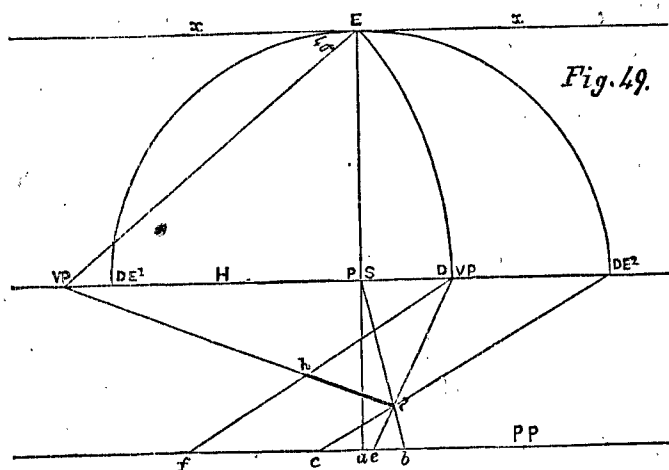


Fig. 49.

between the two would form right angles with the PP. Now it is necessary to set off on the HL the distance of the eye from the PP, that is, the distance from E to PS, for a reason to be explained presently; therefore, the proper way to do that is to draw a semicircle, and mark the extremities meeting the HL as DE^1 and DE^2 . In the eidograph (Fig. 21), the dotted semicircle through the eye E (ending on one side at DE^1 and the other at DE^2) is in an horizontal position; it is afterwards supposed to be turned up, or rabatted, upon the PP passing through E^2 (to the same points). This will be the position in which we shall place it for the future, and as seen in the figures which immediately follow Fig. 21. To proceed with Fig. 49: draw a line xx tangential to the semicircle, and parallel to the HL or PP. Our problem states that the inclination of the pole to be represented is at an angle of 40° with the PP. Therefore, from E draw a line at that angle with xx , meeting the HL in VP. There will be no difficulty in comprehending this, if we consider that because xx is parallel with the PP, therefore if the plan of an object is known to be at a certain angle with the PP (as in the ground-plan method), it will form

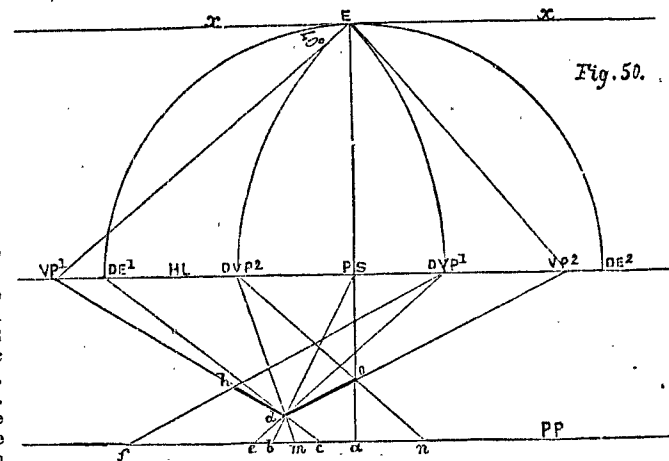


Fig. 50.

the same angle with xx . This, then, is the way a VP is found without the necessity of a plan. From PS draw the perpendicular rs , and mark one foot to the right of a , viz., a, b , because the nearest end of the pole is 1 foot to the right of the eye. Draw b, rs , and somewhere upon b, rs will be found the position of the nearest end of the pole, to be determined in the following manner:—From b set off b, c equal to 2 feet, draw a line from c to DE^2 , cutting b, rs in d , the point required. This, with the exception of the plan, is precisely the same that was done with the line A, B in Fig. 23, that is, by making c, d equal to c, A , a was found to be the nearest end of the line A, B . We now come to a stage of the proceedings which will demand the closest attention of our pupils. It is that of cutting off a portion of a vanishing or retiring line, to give the perspective length of the object, in this case the pole. From d , the nearest end of the pole, draw a line to the VP (the vanishing line of the pole); upon this line will be cut off the perspective length, as follows:—From VP, with the radius VP, E , draw the arc E, DVP ; DVP is the distance of the eye from the VP, and is set off upon the HL upon the same principle as the other distance points are placed; the use of this distance point is to enable us to cut off upon the

vanishing line the length required, in the same way that we used the DE^2 for cutting off the point d in the line b, rs . From DVP through d draw a line to meet the PP in e , make e, f equal to the length of the pole, 6 feet, and from f draw another line back to the DVP , cutting the vanishing line from d in h ; h, d will then be the perspective length and representation of the pole. We must dwell upon this for a minute or two, as this cutting (as we term it) a vanishing line is important. Our pupils will have observed

that we drew a line, commencing from the DVP , through d to e , and after we had marked the given length e, f on the PP, we drew from f back again to DVP ; in other words, in order to determine the space upon the PP which is to contain the length of the pole, and at the same time secure the perspective position, we brought the nearest end, d , of the pole to the PP at e , measured its length, e, f , and then ruled back again to the distance point. This may be summed up in very few words, in the form of a rule to be remembered—that every vanishing line is cut by its own distance

point. The ability to draw an object in perspective upon this lineal system depends principally upon a clear understanding of the above rule in the several ways in which it may be applied. We advise our pupils to get this first problem well up, by doing it again at other angles, and other given distances and proportions. Afterwards they will have very little difficulty in understanding all that is to follow.

PROBLEM XXVIII. (Fig. 50).—Two lines, each 3 feet long, form a right angle; one of the lines is at an angle of 40° with the picture; height of eye, distance, and scale as in the last problem.

Draw the PP, horizontal line, and semicircle through E at the given distance as before, make E, VP^1 at an angle of 40° with xx , and draw E, VP^2 at a right angle with it. From each of the vanishing points draw arcs from E to the HL for the respective distance points; produce E, rs to a , and make a, b equal to 2 feet; join b, rs , make b, c equal to 1 foot, and draw a line from c to DE^1 ; where this last line cuts b, rs in d will be the position of the angle; draw a line from d to VP^1 . Now we must remember the rule given in the

last problem, every vanishing line is cut by its own distance point; consequently, as DVP^1 is the distance point of VP^1 , we must draw a line from DVP^1 through d to the PP at e , make e, f equal to 3 feet, the length of one of the lines forming the right angle, and from f rule back again to DVP^1 , cutting d, VP^1 in h ; h, d will be the length of the line. The other line of the right angle must be similarly treated; as it vanishes at VP^2 , the distance point of VP^2 must be used for cutting; off its perspective length, by bringing a line first from DVP^2 through d to the PP at m ; make m, n equal to the length of the line, and draw from n back again to determine o in the vanishing line; h, d, o will be the perspective representation of the right angle as required.

RECREATIVE NATURAL HISTORY.

THE OX FAMILY.

OUR common ox, the pride of every Smithfield Cattle Show, is so well known that any notice of such a quadruped may seem superfluous; but as a study of the most familiar forms of life is sure to disclose some peculiarity of structure, or to recall some important historical fact, we may be certain that this will be the result in the present case. If one were to ask what animal has most aided man in his progress to civilisation, the answer must probably be the ox. In the first stage of savage life, when food is procured by hunting wild beasts, the dog may be the most valued servant. But when this rude state has been passed, the ox becomes man's trusted friend, providing him with food and clothing, drawing the plough, and moving the wagon. It was not, therefore, wonderful that the early races of men should exalt this animal to the rank of a deity. Thus we see the wisdom of Egypt and the might of

Assyria bowing before the symbolic bull; and even the chosen people of Heaven were deluded into worshipping the golden calf, and listened without sign of horror to the words, "These be thy gods, O Israel."

Few readers need to be reminded that the ox belongs to the order Ruminantia (ruminants), and to the family Bovidae,* a term including the ox, bison, buffalo, and all other species or varieties. The horns of all the family are hollow and permanent, resembling in these two particulars those of the sheep, goats, and antelopes.

A vehement dispute has long raged respecting the origin of our common ox. One naturalist sees the original breed in the wild cattle still kept in Chillingham Park, Northumberland. Another regards the formidable urus, or wild bull of ancient Germany, as the ancestral type. But if we may trust the description given of these by Caesar, they could scarcely have been the fathers of our present cattle. The great Roman says these ancient bulls of the German forests were nearly as large as elephants, and that their horns were capacious enough to form drinking vessels.† We shall have a word to say about these large horns hereafter. At present it may suffice to remark, that the existing breed of oxen cannot well be traced from the fierce and gigantic urus of Caesar. The European bison, which is thought to be still wandering in the wild regions of the lower Danube, has been regarded by a few as the parent stock. The examinations of Cuvier and other anatomists show this to be almost impossible. He mentions one structural difference only in proof of this. Our oxen have thirteen pairs of ribs, but the

* This term is derived from *bovis*, the genitive of *bos*, the Latin for ox. The real root is the Greek *βους* (*bous*).

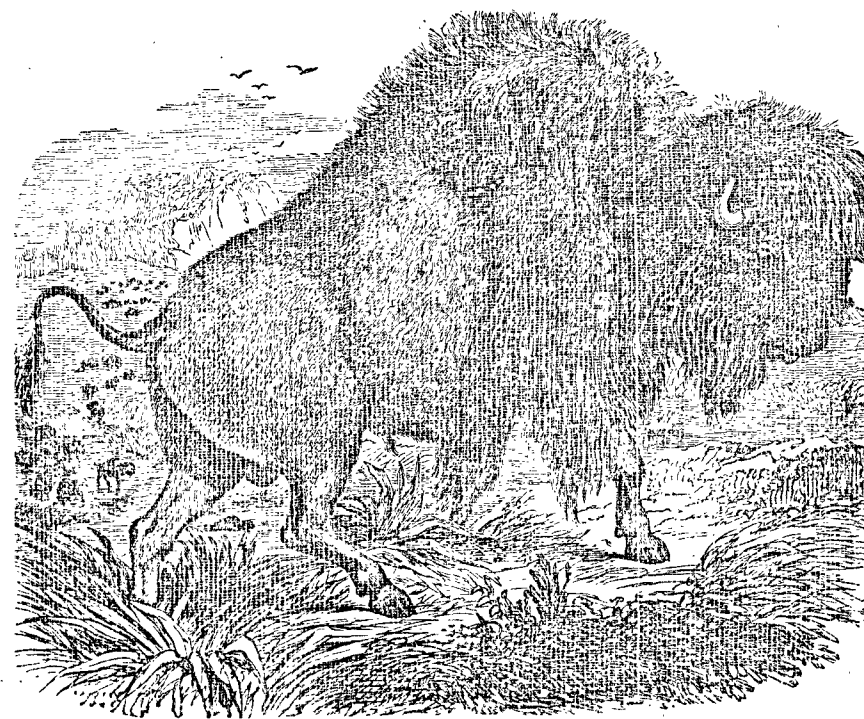
† "De Bello Gallico," lib. vi., cap. 23.

bison or aurochs has fourteen. Many other anatomical peculiarities completely separate the bison from our oxen. Some writers, despairing of finding the parent race in Europe, trace it to the buffalo of Asia, while Cuvier himself inclined to the belief that the ancestors of our farm-oxen have become extinct. We must, therefore, look for the primary types of our Devons and Herefords in those fossil bones so often found in the upper deposits of the tertiary formations. Nor shall we probably go far wrong if we regard the wild cattle of Chillingham Park as very closely allied to some of our existing breeds. These brief remarks may suggest to the reader some notions of the difficulties encountered in tracing the history of our most common animals.

We must not pass on without at least indicating some of the more remarkable species of the bovine family. No reader will wish us to lose time in technical descriptions of the various improved breeds reared for the market—topics suited to an agricultural journal, but out of place in these pages. Nor can

we describe all the widely-extended species of this family, but only those which are most remarkable for peculiarities of form, habits, or historical associations.

The Chillingham wild cattle, to which reference has been already made, demand a few words more. It is probable that we see in these the descendants of the wild bulls which in the reign of King Henry II. roamed in the wide forests then extending far around London. They are cream coloured, but have black muzzles, and ears of a reddish tint. The horns are short, black on the tips, and have



THE AMERICAN BISON OR BUFFALO.

a slight curve upwards. Some of the bulls possess a short mane. Those who have seen them for the first time in the solitudes of Chillingham, have been struck by their peculiarly wild habits. No sooner does the herd behold a strange visitor than the whole body dash away, as if in flight. After running for about a hundred yards they stop, turn round, and advance, as if to charge the intruder, then suddenly pause at some distance, scrutinising the object before them. Should the man wave his arms, off they dart again, but to a shorter distance; then turning, dash forwards as before, coming nearer than at first. Thus, by a succession of retreats and advances, the animals at last come so near that the visitor receives warning to retire, lest the wild herd should finish by a fatal charge. Here is indeed a splendid zoological study for all who can gain an admission to such a collection. Once or twice the herd has been on the point of perishing from disease; but the care now taken will, it is hoped, long preserve these few remains of the wild forms of nature. Readers who have seen Landseer's famous picture of the Chillingham wild bull are able to form some notion of the force and beauty of the living animal.

Far different from these wild cattle of Britain is the bison of America, with its huge lion-like mane, lumped back, and vindic-

tive eye. It is singular that our common cattle, the aurochs or European bison, and the bison of America should each differ in the number of the ribs. The domesticated ox has but thirteen pairs, the aurochs fourteen, and the American bison fifteen pairs. These wild cattle of the New World are sometimes, though improperly, called buffaloes, but the name is of small importance, the chief fact calling for notice being the countless hosts which spread over the prairies. Some of these droves are estimated at 20,000 head of majestic cattle, many being eight feet long, and weighing nearly eighteen hundredweight each. No wonder is it that the fiercest wars between the Indians and the white races should arise from the intense desire of the red men to keep the magnificent hunting-grounds of the bison regions for themselves. If the white man should advance, as he surely will, the bison will depart or perish, for the European slaughters them by tens of thousands for the hides and tallow only. Nor will this be matter for wonder, when it is remembered that 150 pounds weight of fat are obtained from the best animals, and that the hides are so valuable as to have been called "Californian bank-notes." Then the white man is grieved at the dearth of meat in the crowded homes of civilisation, and is forming societies for preserving bison beef, and transporting it to the meat market of England. The red man has heard of this, and is gloomily pondering over the one great article of his creed, "If white man comes, bison goes." But the departure or destruction of these wonderful herds means the annihilation of the red tribes. Therefore is it that, during the present century, the rifles have flashed so often along the Indian frontiers. The bison is the main cause of the contest. "Why don't the red men plough the ground? then there would be lots of food, and to spare," cries the exasperated white settler, whose house has been burnt by the savages. There is just the difficulty. The Indian will not plough; therefore he must hunt; therefore he relies on the bison; and therefore he tries, but all in vain, to stop even with rifle and tomahawk, the white man's resistless march. Such is the importance of one member of the ox family in the far West.

Every poor man in England has an interest in the matter; for already, from the wild herds of the American Continent vast stores of meat are procured and sent to this country, preserved by packing in ice, &c. Such meat now finds a ready sale in Great Britain, and the trade in it bids fair to assume gigantic proportions.

Another American animal, the musk-ox (*Ovibos moschatus*), is remarkable for three peculiarities—the shape and size of its singular horns, the great length of the fine hair, and the fondness of the animals for the wild deserts of the North American wastes. These herds wander far within the Arctic circle, disputing for the lichens and northern herbage with their rivals, the reindeer. Often is a solitary Esquimaux tribe roused from its torpor by the appearance of a herd of musk-oxen, thirty or forty in number, which thus offer to the wild people of the Arctic shores a prospect of high feasting and jollity. Clothing, too, equal to the highest notion of an Esquimaux belle, is furnished by the beautiful hair of the musk-ox, which is twisted into many a curious form by the damsels of the frigid zone. The name given to this ox by the Cree Indians signifies "ugly bison," and this, though not complimentary, is much more suitable than the absurd name of musk-ox. The designation of "little bison," given by some Indian tribes, is much more appropriate. The scientific name, *Ovibos*, assumes that the animal combines the qualities of the sheep (*ovis*) with those of the ox.

The buffalo of South Africa (*Bos Caffer*) is immediately distinguished from his American relative by the absence of the shaggy mane, the large spreading horns, and the more massive form of the body. These animals resemble the bison in two respects—the tendency to associate in large herds, and their desperate courage when wounded.

We must omit any detailed description of the Abyssinian ox, having its horns hanging as it were by hooks to the head; of the zebu, or sacred bull of India, as gentle, and yet as impudent, as a spaniel; and of various other species, simply from want of space. The above references will suffice to suggest to the reader the wide extent of the ox family.

As these animals are classed among the Ruminants, a few remarks are necessary on the complex stomachs belonging to each quadruped of the order. Every reader is probably aware that all ruminants masticate their food a second time; or rather,

first swallow, and then, after some time, commence the chewing process, called "ruminating" by the learned, and "chewing the cud" by the peasant. Let us trace this process in our well-known friend the cow. We see the tongue collecting a mouthful of grass into a small bundle, which is then nipped off by the combined action of the teeth of the lower jaw and the grasping power of the muscular lips. It will be observed that the cow does not pause to masticate the grass, but swallows, or, as some would say, "bolts" the whole. The matter, thus speedily disposed of, is deposited for awhile in the first stomach or rumen, which serves as a kind of cupboard or store-room, in which the food is kept till wanted for further operations. It consists of four small sub-divisions, and the coat is covered with thousands of little elevations, which doubtless produce some chemical change on the newly-received food. The diseases of this stomach often demand the attention of the rustic "cow doctor," and even of the skilled veterinary surgeon. Here are frequently formed dangerous concretions of hardened vegetable or even mineral matters. The once famous bezoar stones, supposed to be universal remedies against poisons, were simply formed by disease in the stomach of the wild goat of Persia. These masses of phosphate of lime have been sold for five or six times their weight of gold! From this first large stomach the food descends into the second, much smaller, but exceedingly complex in structure. It is covered with multitudes of small cells, from which it is often called the *honeycomb bag*. The food is so acted upon in this receptacle as to take usually the form of compact and rounded masses, which are returned from this second stomach, by a peculiar muscular action, through the gullet into the mouth. Then begins the process properly called ruminating, during which the cow seems to enjoy the very perfection of animal bliss. As each portion of the food is re-masticated, it is passed from the mouth direct into the third stomach. This is accomplished by the closing of the tube which leads to the first and second stomachs. This third receptacle is very small, and is called the *manipulus*, from the numerous folds, arranged like the leaves of a book, of which it is composed. Between these active folds the food rests a short time, and is then passed into the fourth or true stomach, where the final processes of digestion are completed. This short description will perhaps suffice to show how exceedingly complex is the organisation by which grass is gradually changed into beef. Many other peculiarities of structure must be passed over for the present, our only reason being want of space to treat such topics satisfactorily.

Allusion has been already made to the gigantic horns of some ancient oxen; and many readers will doubtless recollect those famous historical drinking horns, still held as heir-looms by some old families, especially those of Aubrey and Pusey. The Borstal horn was the symbol by which Edward the Confessor conveyed a large estate to one Nigel, who killed a savage boar which had impaled the person of royalty in the neighbourhood of the palace at Brill. From the family of Nigel the treasured horn has descended, with the Borstal estate, to that of Aubrey. The Pusey horn, above two feet long, has an inscription which declares it was delivered by that descendant of Odin, King Canute, to "Wylliam Pusey." Such ox-horns truly deserve their honours.

We must not, however, forget the extraordinary veneration for the ox in ancient days, the solemn worship paid to his highness while living, the national mourning for him when dead, and the embalming of his venerable body, for the admiration of after ages. It was not, indeed, every ox which was thus honoured, even in Egypt. That would have been too expensive even for the Pharaohs. But the homage paid to Apis at Memphis, and his brother Mnevis at Heliopolis,* must have shed a reflected splendour on all humble bovidæ. Nor must we forget the honours paid to the bull at Nineveh, where the figure of the animal was combined with the human and cherubic forms. The man-headed and winged bulls now in the British Museum attest the extraordinary veneration for the ox "that eateth hay." Even at this day India regards the white bull as a symbol of her great divinity, Siva.

In all these rude, wild, and pagan customs we may trace the feeling of great benefits flowing to mankind from the docility, strength, and labours of the ox.

* Called Beth-sheanesh, and also On, in the Old Testament.

LESSONS IN ALGEBRA.—IX.

FRACTIONS.

117. FRACTIONS in algebra, as well as in arithmetic, have reference to parts of numbers or quantities. The term is derived from the Latin word *fractio*, which signifies a breaking into parts.

Thus, $\frac{a}{2}$ is $\frac{1}{2}a$; $\frac{b}{4}$ is $\frac{1}{4}b$; $\frac{2a}{3}$ is $\frac{2}{3}a$; and $\frac{4x}{7}$ is $\frac{4}{7}x$.

118. Expressions in the form of fractions occur more frequently in algebra than in arithmetic. Indeed, the numerator of every fraction may be considered as a dividend, of which the denominator is a divisor.

119. The value of a fraction is the quotient of the numerator divided by the denominator. Thus, the value of $\frac{6}{2}$ is 3; the

value of $\frac{ab}{b}$ is a ; and the value of $\frac{aa-bb}{a-b}$ is $a+b$.

120. From this it is evident, that whatever changes are made in the terms of a fraction, if the quotients be not altered, the value of the fraction remains the same. For any fraction, therefore, we may substitute any other fraction which will give the same quotient.

Thus, $\frac{4}{2} = \frac{10}{5} = \frac{4ba}{2ba} = \frac{8dx}{4dx} = \frac{6+2}{3+1}$, etc.; for the quotient in each of these instances is 2.

121. It is also evident, from the preceding articles, that if the numerator and denominator be both multiplied, or both divided, by the same quantity, the value of the fraction will not be altered. Thus, $\frac{2}{3} = \frac{2 \times 9}{3 \times 9}$, each term being multiplied by 9; and $\frac{24}{8} = \frac{24 \div 3}{8 \div 3}$, each term being divided by 3, and the result by 3 again.

So $\frac{bx}{b} = \frac{abx}{ab} = \frac{3bx}{3b} = \frac{4bx}{4b}$; for the quotient in each case is x .

122. Any integral quantity may, without altering its value, be expressed in the form of a fraction, by making unity or 1 the denominator; or by multiplying the quantity into any proposed denominator, and making the product the numerator of the fraction required. Thus, $a = \frac{a}{1} = \frac{ad+ah}{d+h} = \frac{6ad}{6d+h}$; the quotient if each of these being a .

Also $d+h = \frac{dx+hx}{x}$; and $r+1 = \frac{2dr+2dr}{2dr}$.

ON THE SIGNS OF FRACTIONS.

123. Each sign in the numerator and denominator of a fraction affects only the single term to which it is prefixed. The dividing line answers the purpose of a parenthesis or vinculum, namely, to connect the several terms of which the numerator and denominator may each be composed. The sign prefixed to it, therefore, affects the whole fraction collectively and every term individually. It shows that the value of the whole fraction, and of course every term, is to be subjected to the operation denoted by the sign. Hence, if the sign before the dividing line be changed from + to —, or from — to +, the value of the whole fraction is also changed.

Thus it is plain that the value of $\frac{ab}{b}$ is a . [Art. 111.] But this will become negative if the sign — is prefixed to the fraction.

Hence, $y + \frac{ab}{b} = y + a$. But $y - \frac{ab}{b} = y - a$.

124. In performing fractional operations there is frequent occasion to remove the denominator of the fraction; also to incorporate a fraction with an integer, or with another fraction. In each of these cases, if the sign — is prefixed to the dividing line, the signs of all the terms of the numerator must be changed, as in Art. 64, where a parenthesis, having the sign — before it, is removed.

Thus $b - \frac{ad+ah}{a} = b - d - h$; and $b - \frac{ad-ah}{a} = b - d + h$.

Next, if all the signs of all the terms in the numerator of a fraction are changed, the value of the fraction is changed in the same manner. Thus, $\frac{ab}{b} = +a$ [Art. 101]; but $-\frac{ab}{b} = -a$.

And $\frac{ab-bc}{b} = a-c$; but $-\frac{ab-bc}{b} = -a+c$.

Again, if all the signs of all the terms in the denominator of a fraction are changed, the value of the fraction is also changed.

Thus, $\frac{ab}{b} = +a$; but $-\frac{ab}{b} = -a$.

125. If then the sign prefixed to a fraction, or the signs of all the terms of the numerator, or the signs of all the terms of the denominator, be changed, the value of the fraction will be changed from positive to negative, or from negative to positive.

126. If the same change be made upon the numerator and denominator of a fraction at the same time, they will balance each other, and the value of the fraction will not be altered. Thus, by changing the sign of the numerator, the fraction $\frac{ab}{b} = +a$

becomes $-\frac{ab}{b} = -a$. But by changing the signs of both the nu-

merator and the denominator, it becomes $-\frac{-ab}{-b} = +a$, where the original value is restored.

By changing the sign before the fraction, the expression $y + \frac{ab}{b} = y + a$ becomes $y - \frac{ab}{b} = y - a$. But by changing the sign of the numerator also, it becomes $y - \frac{-ab}{b}$, where the quotient — a is to be subtracted from y , or

which is the same thing [Art. 58], $+a$ is to be added, making the value $y + a$ as at first. In like manner, $\frac{6}{2} = \frac{-6}{-2} = \frac{-6}{-2} = \frac{6}{2} = 3$.

And $\frac{6}{-2} = -3$. And $\frac{-6}{2} = -3$. And $\frac{-6}{-2} = 3$.

Hence the quotient in division may be set down in different ways and still have the same value. Thus $(a-c) \div b$ is either $\frac{a-c}{b}$, or $\frac{a}{b} - \frac{c}{b}$.

REDUCTION OF FRACTIONS.

127. A FRACTION may be reduced to lower terms, by dividing both the numerator and denominator by any quantity which will divide them without a remainder; or by throwing out any factor common to both. According to Art. 121, this process will not alter the value of the fractions.

EXAMPLE.—Reduce $\frac{ab}{cb}$ to lower terms. Ans. $\frac{a}{c}$.

128. If the same letter or combination of letters is in every term, both of the numerator and denominator, it may be cancelled, for this is dividing by that letter or combination of letters. [Art. 98.]

EXAMPLE.—Reduce $\frac{3am+ay}{ad+ah}$ to lower terms. Ans. $\frac{3m+y}{d+h}$.

129. If the numerator and denominator be divided by the greatest common measure, it is evident that the fraction will be reduced to the lowest terms.

EXAMPLE.—Reduce $\frac{5a^4}{3a^2}$ to its lowest terms.

Here, $\frac{5a^4}{3a^2} = \frac{5aaa}{3aa} = \frac{5aa}{3}$. Ans.

EXERCISE 13.

Reduce the following fractions to lower terms:—

- | | | |
|----------------------|-----------------------------------|----------------------------|
| 1. $\frac{6dm}{8dy}$ | 3. $\frac{a+bc}{(a+bc) \times m}$ | 5. $\frac{dxy+dy}{dxy-dy}$ |
| 2. $\frac{7m}{7mr}$ | 4. $\frac{am+ay}{bm+by}$ | |

EXERCISE 14.

Reduce the following fractions to their lowest terms:—

- | | |
|--|--|
| 1. $\frac{6x^2}{3x^2}$ | 7. $\frac{3x^3+2x^2-x^2-2x+3}{x^3-5x^2-5x+1}$ |
| 2. $\frac{3a^4+4a^3}{5a^3}$ | 8. $\frac{x^4-x^3-2x^2+2}{2x^3-x-1}$ |
| 3. $\frac{8a^2y-12a^2y^2+6ay^3}{a^2y+4ay^2}$ | 9. $\frac{12x^4-5x^3+44x-5}{3x^4+20x^3-57x^2+80x-50}$ |
| 4. $\frac{x^2+2xy+a^2}{x^2+a^2}$ | 10. $\frac{16x^4-83x^3+15x+6}{8x^4-30x^3+31x^2-12x}$ |
| 5. $\frac{x^3-a^3}{ax-a^2}$ | 11. $\frac{24x^5-22x^4-14x^3+24x^2-8x}{18x^5-18x^4-14x^3+30x^2-12x}$ |
| 6. $\frac{8a^3-27b^3}{4a^2-9b^2}$ | |

KEY TO EXERCISES IN LESSONS IN ALGEBRA.

EXERCISE 8.

1. $x - y$.
2. $a - b$.
3. $b + c$.
4. $aa - ax + xx$.
5. $x - ax + 3ax$.
6. $1 - x$.
7. $c + d + \frac{x}{a+b}$.
8. $a + b + \frac{y}{d-n}$.

EXERCISE 9.

1. $2ay + ax - 3bm + 4$.
2. $4a - 3 + 2y + 1 - 5ad + \frac{1}{2}m$.
3. x .
4. $\frac{a}{x} - \frac{d}{1} + \frac{xy + 4my + 6}{a}$.
5. $\frac{x-a-3}{d} - \frac{a}{ay} + \frac{1}{my}$.
6. $\frac{3}{rd} + \frac{1}{ad} - \frac{h}{2ar} + \frac{3}{ard}$.
7. $\frac{3}{2y} - \frac{2}{axy} + \frac{1}{2a} - \frac{3h}{2ax}$.
8. $4cx - 3xy + 6cd - 5hg$.
9. $3by + 6cd + 2a - 5ab$.
10. $4z - 2hd + 8m$.
11. $a - 12b + \frac{14}{x} - 24c + 10a$.
12. $-10ab + (x+y) - 18 - 3(a+b)$.
13. $x - 12c$.
14. x .
15. 2 .
16. $b + d - x(a+b) + 42xy - b$.
17. $3 + \frac{5b}{m} - \frac{10}{am} + \frac{6d}{an} - \frac{17}{2m}$.
18. $\frac{1}{6} + \frac{1}{y^2} + \frac{1}{3xy} - \frac{1}{6xy} + \frac{1}{3}$.
19. $\frac{1}{b} + \frac{2}{a} + \frac{1}{c} + \frac{5}{5abc} + \frac{1}{3}abc$.
20. $3axy + 8ax - 10bcm + 12a$.
21. $-4x + 6 - 2a - 21 + 5ax + \frac{4}{3}$.
22. b .
23. $x + y$.
24. x .
25. $2b + \frac{2}{a}$.
26. $2x - b + c + \frac{h}{3a+y}$.
27. $aa + 2a - 4$.
28. $b + 2c$.
29. $4a^2 + 2ab + b^2$.
30. $x^2 - 2ax + a^2$.
31. $2y^2 - 3y + 2$.
32. $a^4 + a^3 + a^2 + a + 1$.
33. $2ax - 3x + 1 - \frac{2a^2 + 3x - 1}{2}$.

EXERCISE 10.

1. bc^2 and x^2y^4 .
2. am and am^2n .
3. $a^2 - ax + a^2$.
4. $2a^2 - a^2y - 2xy^2$.
5. $a^2b - 2ab^2$.
6. $x^3 - 3ax^2$.
7. $x^2 + 3xy - 2y^2$.
8. $x^2 - 3x - 2$.
9. $x + a + \frac{2a^2}{x-a}$.
10. $a + b - c$.
11. $27x^3 - 18x^2 + 12x$.
12. $x - \frac{ax^2 - a^3}{x^2 + a^2}$.
13. $2y^2 - 3xy - 2a^2 - \frac{5ay^2 - 2a^2y^2}{5y^2 - 4ay^2 + a^2y^2}$.
14. $7x - 5$.
15. $2x^3 + 5x^2y + 22xy^2 + 8y^3 + \frac{33y^4}{x-4y}$.
16. $a^3 - 2a^2 + 3x - 4 + \frac{5x+4}{a^2+2x+1}$.
17. $a^3 + 2x^2 + 3x + 4 + \frac{5x-4}{a^2-2x+1}$.
18. $a^2 + 3x + 7 + \frac{7x-7}{a^2-3x+2}$.
19. $5x^2 - ax - 6a^2 - \frac{3a^2x - 5a^2}{a^2 - az + a^2}$.
20. $a^3 + 3x^2r + 3xr^2 + r^3$.
21. $3x^3 - 9x^2 + 2x - 1$.
22. $3a^2b + 2ab^2 - 2b^2c - 3bc^2$.
23. $a^2 + ab + b^2 + bc + c^2 - ac$.
24. $2x^2 - 3x^2 + 2x^2$.
25. $x + 2x^2 + 3x^3 + 4x^4 + 5x^5 + 6x^6 + 7x^7 + 8x^8$.

EXERCISE 11.

1. $x + b$.
2. $c + x$.
3. $a^3 - 8x - 3$.
4. $x^2 - b^2$.
5. $x + 1$.
6. $x - a$.
7. $a - 2b$.
8. $a^2 - a^2$.
9. $a + b$.

EXERCISE 12.

1. $bcep$.
2. a^2b^3 .
3. $Obabedef$.
4. $(a^2 - b^2)^3$.
5. $36a^2$.
6. $a^4 + a^2x - ax^2 - x^4$.
7. $x^4 - a^4$.

GREAT BOOKS.

XVI.—CHILDE HAROLD.

In the year 1807, a young nobleman, not quite out of his teens, published a small volume of poems, under the title of "Hours of Idleness," the contents of which were scarcely superior to the ordinary run of verses written by sentimental youths who think they have a special aptitude for poetic composition. The book was very severely handled by the *Edinburgh Review*, then a new organ of criticism, and famous for the trenchant style in which it treated all offenders against its literary canons. Some sensitive natures would have been discouraged by this rough reception; but Lord Byron, the author of the "Hours of Idleness," was not the man to "let himself be snuffed out by an article," as he afterwards believed was the case with Keats. He wrote a satire on his assailants, and his "English Bards and Scotch Reviewers," which saw the light in 1809, gave him a position as a writer of some mark and promise. Nevertheless, it was not until 1812, when the first part of "Childe Harold"

appeared, that the poetical powers of Byron were generally acknowledged. Between the publication of the retort upon the Edinburgh critics and the issue of "Childe Harold," Byron had travelled in Portugal, Spain, Greece, and Turkey, and his mind seems to have been enlarged and vivified by the variety of experiences with which he thus came in contact—the splendid scenery, the grand historical and literary associations, and the rich and passionate developments of life and character, which he found in lands warmed by a brighter sun, and kindled by more glowing skies. After the appearance of "Childe Harold," the critical and the uncritical agreed that a new poet had risen above the horizon.

Even at the present day, "Childe Harold" is the best known of Byron's poems, unless it be considered that distinction belongs more properly to "Don Juan." It is not the best of his works, since it does not, as a whole, show the full maturity of his genius; but it contains some of the most distinctive evidences of the power which we recognise as "Byronic," and it has furnished many familiar phrases to the language. A close inspection, however, shows that the poetic qualities of Byron were developed in the process of writing this poem. He does not seem to have begun his work with anything like a clear conception of what he was going to do with it. The manner alters as he proceeds, to an extent which indicates a considerable change in the mind of the writer. The style of the opening pages recalls those half-burlesque and wholly superficial imitations of Spenser, such as Shenstone's "Schoolmistress," which were at one time reckoned among the choicest of literary puerilities, but which are now happily abandoned by all. An affectation of old English phraseology is ostentatiously introduced. We continually find such lines as—

"Nor mote my shell awake the weary Nine;"

"Whilome in Albion's isle there dwelt a youth
Who ne in virtue's ways did take delight;"

"And where these are, light Eros finds a feere;"

all of which we are to accept as semi-humorous reproductions of Spenserian simplicity. The very title of the poem is conceived in the same spirit of sham antiquity; "Childe" being an Anglo-Saxon word, signifying the son of a nobleman or a knight.

As he progressed, Byron would appear to have been disgusted by the false pretence of this so-called Elizabethan manner, which bears no true resemblance to the reality it assumes to mock. He next slid into a style which was much more natural to him—the conventional style of the latter half of the eighteenth century—the style which Wordsworth had even then been labouring nearly twenty years to upset, but which always had its charms for Byron. Every quality or emotion of the mind is personified; every noun is linked to its accustomed epithet. The crags are "horrid," the cork-trees are "hoar," the deep is "unruffled," the hills are "romantic." Scorn points her finger, and Pomp varnishes guilt. The moralising, puerile, if it be not rather of that insincere and superficial order which belongs to men whose morals go no deeper than their phraseology. Yet the style acquires a greater firmness as the poet advances on his path. The affectation of Spenserianism is abandoned—except in a few rare instances—long before the end of the first canto; a certain fulness takes possession of the verse; a certain impetus sweeps on from stanza to stanza. It is difficult to say in what lies the power of the poem, unless it be in the revelation of a strong and vivid personality. On analysis, much of the matter in these earlier parts proves to be commonplace; yet there is something behind which is not commonplace. This must be Byron himself—the man, as distinguished from the author.

That Childe Harold was intended by Byron as in some measure a representation of his own nature cannot be doubted. The hero of the poem is a young nobleman satiated with a few years of pleasure and debauchery, who seeks foreign lands in the vain hope that change of scene will restore his interest in life, and lull the feelings of remorse with which his mind is tormented. He is a cynic and a misanthrope, yet a man capable of quick and keen observation. All this may be equally said of Byron. Owing to a wilful disposition and a bad bringing up, the poet, while still a youth, had so exhausted the capacity

of enjoyment that he could write of himself, in one of his early poems:—

"Weary of love, of life, devour'd with spleen,
I rest a perfect Timon, not nineteen."

The imaginary Childe Harold finds no repose in foreign travel, as the real Byron found no solace. He passes through the fairest and most interesting regions of Southern Europe, through Germany and Switzerland, without being able to lay the spectre of a troubled conscience. But the nominal hero of the poem is hardly a character at all, excepting in as far as his gloomy spirit colours the whole body of the work. In "Childe Harold" there is literally no story. The poem is simply a collection of descriptions and meditations, and it is surprising that it should so quickly have taken hold of the public mind. Yet Byron happily and wittily expressed the truth when he said that, after the publication of "Childe Harold," he awoke one morning and found himself famous. The third and fourth cantos of the poems were written some years later than the two first; and they show an immense and progressive improvement in the poetic art. The thought deepens; the personality of the writer stands out with more force and splendour; the observation of nature is more true and original; the language is richer, the versification stronger and more varied. The stanza is that of the "Faery Queen," to which Byron gave a new modulation and expression, often too rhetorical, but, in the latter portions of the poem, remarkably powerful. "Childe Harold" has many faults and shortcomings; but it has taken its place among the immortals, and from that place it is not probable that it will be cast down.

LESSONS IN GERMAN.—XLII.

SECTION LXXXVI.—IDIOMS OF VERBS.

Prüfen, when used transitively, signifies "to test, or try by tasting;" as:—*Er kostet den Wein*, he tastes the wine.

Verfügen has sometimes the same signification; as:—*Er verfügte den Wein*, he tries the wine (that is, by tasting).

1. *Schmecken*, to relish, denotes properly the impression made by tasting; as:—*Der Wein schmeckt gut*, the wine tastes good. *Es schmeckt mir nicht* (it does not relish to me), I do not relish it. *Die Speise schmeckt nach Rauch*, the food tastes of smoke (is smoky).

VOCABULARY.

<i>Ändern</i> , to alter.	<i>Verfälschen</i> , m. jailer.	<i>Stellung</i> , f. situation.
change.	<i>Kuchen</i> , m. cake.	<i>Verfügen</i> , to procure.
<i>Bitter</i> , bitter.	<i>Freigeben</i> , to set free.	cure.
<i>Empfangen</i> , to receive.	release.	<i>Wunder</i> , n. wonder.
	<i>Mißbrauchen</i> , to misuse.	miracle, prodigy.
<i>Gemüse</i> , n. vegetables.	<i>Selig</i> , blissful, blessed.	<i>Büchtlung</i> , f. chastisement, correction.
<i>Jetzt</i> , present.	ed, happy.	

RÉSUMÉ OF EXAMPLES.

<i>Die That ist geschehen</i> , und alle Reichthümer der Erde können sie nicht ungeschaffen machen.	The deed has transpired, and all (the) riches of this earth cannot make it otherwise.
<i>Der Tag</i> weiß nicht, was er thun soll (Seet. LXXIV. 2), um sich die Langeweile zu vertreiben.	The slothful (man) knows not what to do in order to drive away (the) tediousness.
<i>Dieser Rindervater</i> schmeckt mir besser, als jenes Geflügel.	This roast beef relishes (to me) better than that poultry.
<i>Es war der Papagei</i> , der gesehen wurde.	It was the parrot that just spoke.
<i>Der Jüngling</i> fühlte sich über den Verlust, den man auf ihn hatte, tief gekränkt.	The youth felt (himself) deeply mortified on account of the suspicion which rested upon him.

EXERCISE 166.

1. Das Unglück ist geschehen, und nicht mehr zu ändern.
2. Wann ist ihm dieses Unglück begegnet?
3. Es geschah vor einer Stunde.
4. Was geschah dann, soll geschehen, um diesen Leuten eine bessere Stellung zu verschaffen?
5. Es ist schon oft der Fall gewesen, daß das Vertrauen mißbraucht worden ist.
6. Es fanden in früherer Zeit mehr Wunder und Zeichen Statt, als in der jetzigen.
7. Es geschah ihm recht, einmal eine Büchtlung empfangen zu haben.
8. Es geschieht nichts ohne Gottes Willen und Wissen.
9. Der Müßiggänger weiß nicht, was er thun soll.
10. Der fleißige Knabe wußte nicht, was er weiter thun sollte.
11. Der Knecht fragte, was er thun solle, um selig zu werden.
12. Wie schmeckt Ihnen das Gemüse?
13. Es schmeckt mir vorzüglich.
- 14.

Schmeckt Ihnen dieser Kuchen nicht? 15. O ja, er schmeckt mir sehr gut. 16. Schmeckt Ihnen das Essen? 17. Nein, Herr Doctor, es schmeckt mir Alles bitter. 18. Ich bin es, der dies spricht und gesprochen hat. 19. Er ist es, der diese Worte zu sprechen wagte. 20. Nicht wahr, Sie sind es, der gesagt hat, man möge die Gefangenen losgeben? 21. Ja, und Sie sind es, der mir widersprochen hat. 22. Diese Worte haben unsern jungen Freund tief gekränkt. 23. Sie scheinen gekränkt worden zu sein. 24. Man darf sich nicht über jede Kleinigkeit gekränkt fühlen. 25. Man darf dem Gedanken, gekränkt worden zu sein, nicht lange in dem Herzen Raum geben. 26. Haben Sie schon dieses Obst versucht? 27. Ja, ich habe es schon versucht.

EXERCISE 167.

1. When did your friend meet with the accident? 2. It happened yesterday; he knows not how to get over it. 3. We will try everything to better his situation. 4. If the circumstances of those people were to be changed, everything would go well with them. 5. It has often been the case that his goodness has been abused. 6. The punishment which those idle boys received was right. 7. Happen what will, I shall trust in God. 8. What is done cannot be undone, and what has been said cannot be unsaid. 9. Do you relish your food? 10. No, doctor, I relish nothing; everything tastes bitter. 11. It was my friend who spoke these words; they might assist these poor emigrants. 12. What did your new carriage cost (you)? 13. It cost (me) fifty guineas. 14. Have you already tasted this cake? 15. Yes, I have, but I do not like it; have you any other?

SECTION LXXXVII.—IDIOMS OF VERBS (continued).

Verfügen (from *ver*, against, etc., § 97. 3, and *fügen*), has a variety of significations; as, "to put in a wrong place, to misplace, to remove, to pawn;" also, "to set against, i.e., to fetch, deal out, or give," as a blow, etc. It likewise signifies "to reply;" as:—*Auf diese Fragen und Beschuldigungen verfuhr er folgende*, to these questions and accusations he replied as follows (following). *Er verfügte dem Pferd einen Schlag*, he gave the horse a blow. *Der Glaube verfuhr Berge*, (the) faith removes mountains.

1. *Ueber Feld gehen* (literally, to go over field) signifies, "to take a trip across the fields;" as:—*Wir gehen morgen früh über Feld*, we are going to take a trip across the fields to-morrow morning.

2. *Daß* (that) is sometimes used instead of *seit*, and may then be translated "since;" as:—*3ft es lange, daß Sie ihn gesehen haben?* is it long since you have seen him?

VOCABULARY.

<i>Ausbitten</i> , to beg for.	<i>Geldstück</i> , n. gold-piece.	<i>Städter</i> , m. townsman, citizen.
<i>ask for</i> , request.		
<i>Beisehen</i> , to look on, at, to view.	<i>Hierauf</i> , hereupon.	<i>Fahren</i> , to drive.
<i>Daqu</i> , thereto, to it.	<i>Mangel</i> , m. want, lack, deficiency.	<i>Verräther</i> , f. treachery.
<i>Dürftigkeit</i> , f. necessity, indigence.	<i>Politisch</i> , political.	<i>Verfügen</i> , (See above.)
<i>Einfach</i> , simple, plain.	<i>Postmeister</i> , m. postmaster.	<i>Vormittag</i> , m. forenoon.
<i>Fangen</i> , to take, seize.	<i>Schlacht</i> , plain, homely.	<i>Welttheil</i> , m. part of the world or globe.
<i>flach</i> , flat, even.	<i>ly</i> .	
<i>Flüchtling</i> , m. fugitive.	<i>Spotten</i> , to jeer, jibe, banter.	<i>Wort</i> , n. of what, whereof, whereat.
<i>Fülle</i> , f. fullness, plenty.		

RÉSUMÉ OF EXAMPLES.

<i>Der heimtückische Mensch</i> verfuhr mir mit hinterlistiger Weise einen Schlag in den Rücken.	The malicious man gave me, in a deceitful manner, a blow upon the back.
<i>Der Vater</i> geht diesen Nachmittag über Feld.	The father goes this afternoon over the country.
<i>Er weiß nicht</i> , wie er zu diesem Re-genschirm gekommen ist.	He does not know how he came by this umbrella.
<i>Er geht</i> beinahe alle Tage auf's Land, und erfrischt sich an Milch und Obst.	He goes nearly every day into the country, and refreshes himself with milk and fruit.
<i>Das Verbrechen</i> dieses Mannes ist an den Tag gekommen.	The crime of this man has come to light.
<i>Er ist lange nicht</i> bei uns gewesen.	He has not for a long time been at our house.
<i>Er ist nicht lange</i> bei uns gewesen.	He has not been long at our house.

EXERCISE 168.

1. Er verfuhr ihm einen Schlag in das Gesicht. 2. Scherzweise verfuhr mir die Schwester einen Schlag mit der flachen Hand. 3. Es schied

nicht für Knaben, einander zu schlagen. 4. Der Vater ist über Land gegangen, und wird erst gegen Abend zurückkommen. 5. Mein Bruder war tiefen Vermittag auf dem Felde, um das Korn zu besäen, und diesen Nachmittag geht er in die Stadt, um seinen kranken Vetter zu besuchen. 6. Wie sind Sie zu diesem Goldstücke gekommen? 7. Ich habe es gefunden, als ich auf das Feld ging. 8. Man weiß nicht, wie dieser Mann zu seinem Reichthum gekommen ist. 9. Reiche Leute wohnen den Winter über in der Stadt, und den Sommer auf dem Lande. 10. Wenn reiche und stolze Städter auf das Land kommen, so spötteln sie gern über die schlichten und einfachen Sitten seiner Bewohner. 11. Ludwig XVI. wurde nach an den Grenzen Frankreichs durch die Verrätheri eines Postmeisters gefangen genommen. 12. Der Dieb wurde vom Nachtwächter gefangen genommen, als er aus dem Hause entfliehen wollte. 13. Man mußte lange nicht, wer die Fremden waren, bis es endlich an den Tag kam, daß es politische Flüchtlinge waren. 14. Entsch ist es an den Tag gekommen, worüber Jahre lang der Schleier des Geheimnisses hing. 15. Er ist sich zu mir in den Wagen setzte, bat er sich als Bedingung aus, daß ich langsam fahren möchte. 16. Als er gefragt wurde, warum er diese entwürdigende Handlung begangen habe, versetzte er, daß ihn die Noth dazu getrieben habe. 17. Hierauf versetzte ich ihm, daß Mangel kein Grund zum Diebstahl, und Noth kein Grund zu einem Verbrechen sei. 18. Das Schicksal versetzte ihn aus der Fülle in die größte Dürftigkeit, wie es mich oft aus einer Stellung in die andere, aus einem Lande in das andere und aus einem Welttheil in den anderen versetzte; aber den härtesten Schlag versetzte es mir dadurch, daß es mir an dem Tage meiner Ankunft in Amerika den Bruder sterben ließ.

EXERCISE 169.

1. My brother goes to-morrow morning with his friend over the country, and will return in the evening. 2. How came you by this book? 3. As I went over the country I found it. 4. The father gave the boy a blow with his hand. 5. Upon the questions which the judge asked the criminal, he replied that he had not committed the crime purposely. 6. I have not been for a long time in Germany. 7. I have not been long in Germany. 8. It is a long time since I have seen my parents and brothers. 9. He did not know for a long time who it was that had taken his pencil-case, after it was found. 10. Let us take a pedestrian tour, as we have beautiful weather to-day. 11. How long is it since you have heard anything of your friends? 12. I do not know, but I believe it is more than a month since I have heard anything of them.

SECTION LXXXVIII.—IDIOMATIC PHRASES.

Sin (Sect. XXVII.), applied to time, may refer as well to the future, as to the past; as:—Vis zu dem zwanzigsten Jahrhundert hin können noch viele Ummälzungen, in der alten Welt sowohl, wie in der neuen, Statt finden, up to (between this and) the twentieth century (thither) there may yet, in the Old World, as well as in the New, many revolutions take place. Mander fragt nach einem leichtsinnig verlebten Jünglingsalter, daß nun die günstigste Zeit, um Kenntnisse zu erwerben, hin sei, many a one complains, after a frivolously spent youth, that (now) the most favourable period for acquiring knowledge is past (lost, or gone). In this latter sense, dahin is likewise employed; as:—Die Ernte ist vergangen, der Sommer ist dahin, the harvest is gone, the summer is past.

1. Ginen Schritt thun—to take a step; as:—Welche Schritte müssen gethan werden? what steps must be taken? Schritt halten—to keep step, to keep pace; as:—Dieser Knabe versucht mit dem Vater gleichen Schritt zu halten, this boy tries to keep step with his (the) father. Heinrich ist nicht fleißig genug, um beim Erlernen der deutschen Sprache mit Ernst gleichen Schritt halten zu können, Henry is not diligent enough (in order) to enable him to keep pace with Ernest in learning the German language.

2. Ginen Schuß thun—to make a shot, to shoot; as:—Wie zu diesem Tage hat kein Mensch einen so berühmten Schuß gethan, wie Wilhelm Tell, up to this day has no man made so renowned a shot as William Tell.

VOCABULARY.

Auftrag, m. order, direction.	Erstehen, to freeze, chill.	Majestät, f. majesty.
Ausbessern, to mend, repair.	Grätig, gracious, clement.	Pünktlich, punctual, punctually.
Schämen, to shame, confound, confuse.	Quarrel, m. quarrel, brawl.	Schuss, m. shot.
	Regen, to lay (sich legen, to abate).	Schwertschlag, m. stroke with the sword.

Uebersetzen, to surrender, deliver.
Versehen, to miss, fail.
Versehen, to scare, frighten.

Verjäger, m. provider, sustainer.
Versehen, to miss, fail.
Versehen, to miss the way.

Versehen, to miss, fail.
Versehen, to miss the way.
Versehen, to miss the way.

RESUMÉ OF EXAMPLES.

Wir lieben einen Menschen nicht länger, als wir ihn achten; ist die Achtung hin, so ist es auch die Liebe.
Wer einmal den ersten Schritt zu einem Verbrechen gethan hat, thut auch leicht den zweiten.
Er hat einen guten Schuß gethan.
Er ist sieben an dem Fenster vorüber oder vorbei gegangen.
Er will nicht ausgehen, weil der Wind so stark weht.
Wir werden wohl noch Schnee bekommen.
Es geht ein starker Wind.
Von wem ist die Rede?

We honour a man no longer than we respect him—if (the) respect is gone, so also is (the) love.
He who has taken the first step to a crime, also easily takes the second.
He has made a good shot.
He has just passed by the window.
He will not go out, because the wind blows so hard (strong).
We shall probably yet have (get) snow.
There is a strong wind blowing.
Of whom do you talk (is the question)?

EXERCISE 170.

1. Die beiden Freunde waren es (Sect. XXXV. 6) müde, länger mit einander zu streiten. 2. Der König und die Kaiserin, des langen Feters müde, sie machten endlich Friede (Friede). 3. Da der Wind ziemlich stark und anhaltend wehte, so erlitten wir schon nach vierzehn Tagen Land. 4. Es weht heute ein sehr kalter Wind, und ich befürchte, daß wir Schnee bekommen werden. 5. Der Wind hat sich seit Mittag sehr gelegt; er weht bei weitem nicht mehr so stark, als diesen Morgen. 6. Es ging eine so kalte und schneidende Luft, daß er sich binnen fünf Minuten beide Hände erfroren. 7. Lebt mein Vater noch? 8. Ja, er lebt noch, aber unser junger Freund ist nicht mehr. 9. Weht ihm, er ist hingegangen, wo kein Schnee mehr ist. 10. Er, der Verfolger so vieler Armen, ist nicht mehr. 11. Wovon (Sect. XXVIII.) lebt diese arme Familie? 12. Wovon wird gesprochen? 13. Von wem spricht man? 14. Das ist etwas, wovon Sie nichts verstehen. 15. Wovon ist die Rede? 16. Von wem haben Sie das gehört? 17. Von wem hat zu diesem artigen Geschenk erhalten? 18. Der Willebich schoß nach dem Jäger, allein die Kugel verfehlte ihr Ziel, und ehe er noch einen andern Schuß thun konnte, sank er selbst, getroffen von dem Blei des Jägers. 19. Ihn Schuß und Schneidreich wurde die Stellung übergeben. 20. Er that einige Schritte in dem Garten, um die Vögel zu verschrecken. 21. Der junge Engländer ging stehen an unserer Thüre vorüber. 22. Er ist an mir vorbei gegangen, ohne mich zu erblicken. 23. Dieser Mann hat die günstigste Zeit seines Lebens unbenutzt vorbeigehen lassen. 24. Als Friedrich der Große einen jungen Officier nach einer Schlacht sehr auszeichnete und öffentlich lobte, so antwortete dieser: „Gew. (§ 58. Note) Majestät beschämten mich durch diese Ehre.“ 25. Frage (§ 57. 7) mir diesen Brief auf die Post, Johann, und laß mir diese goldene Uhr ausbessern. 26. Bist Du schon bei dem Herrn Minister gewesen, und hast Du meine Anfrage pünktlich befragt? 27. Ja, gnädiger Herr, ich habe sie ausgerichtet. 28. Ich habe heute keinen Schritt aus dem Hause gethan. 29. Obgleich ich den ersten Schritt zu einer Verwundung gethan habe, so fällt es ihm doch schwer, den zweiten zu thun. 30. In seinem sechzehnten Jahre that er den ersten Schritt in die Fremde. 31. Dieser junge Schüler sucht mit dem ältern gleichen Schritt zu halten.

EXERCISE 171.

1. You will keep pace with your brother if you are more industrious. 2. Go step by step, and thou wilt not miss thy aim. 3. From whom have you received this present? 4. Of what is it made? 5. By whom is it made? 6. Is my mother still alive? 7. Yes, she is still alive; but my father is no more. 8. Peace to him! he is gone where troubles are no more. 9. It blows very roughly to-day, and therefore it is better to stay at home. 10. I think we shall have rain when the wind abates. 11. Do not go out, for the air is so very cutting, and I fear you may chill your hands. 12. As long as the wind is in the east, it will remain cold and dry. 13. Finally, tired of the long quarrel, I made peace with my friends.

KEY TO EXERCISES TO LESSONS IN GERMAN.

EXERCISE 119 (Vol. II., page 282).

1. Was er auch sagen mag, ich werde beharren. 2. Selbst diesem

Gewinn waren sie nicht zufrieden. 3. Das Unglück dieser Familie war so groß, daß sie sogar fremde Leute um Unterstützung baten. 4. Ich werde selbst mit einer Beileitung nicht überein. 5. Der Mond geht uns nicht so viel Licht, als die Sonne, selbst wenn er am hellsten scheint. 6. Was Ihr Freund auch sein mag, Sie werden es nicht erhalten. 7. Wer dieses junge Fräulein auch sein mag, sie ist sehr unfehllich. 8. So süßig sie auch sein mögen, irren sie sich doch zuweilen. 9. So groß auch meine Armuth sein mag, werde ich doch nicht müßlos werden. 10. Was die Neuigkeit auch sein mag, theile sie mir mit. 11. Was ihm auch für Vortheile dargeboten werden, er will sie nicht annehmen. 12. Was er auch für Fehler begangen haben mag, ich werde ihm verzeihen. 13. Selbst in der Hitze der Schlacht, und unter dem Donner der Kanonen, ritt der Feldherr ruhig hin und her. 14. So groß auch mein Unglück sein mag, Niemand soll es erfahren. 15. Selbst der König muß dem Geisse gehorchen. 16. Selbst mein Gegner priest meine Tapferkeit.

EXERCISE 120 (Vol. II., page 283).

1. He who is careful in his youth, need not have cares in his old age. 2. Study thyself, not only in the society of strangers, but also when thou art alone, that thou mayest know thyself. 3. He who does not always study himself, never acquires self-knowledge. 4. The ancient Germans used generally to sacrifice to their gods in old groves of oak. 5. Good children take care of their parents in their old age. 6. My friends are accustomed to drink water in the morning. 7. He takes rest morning and evening. 8. We are accustomed to drink coffee instead of tea. 9. To take care of his health is his greatest concern. 10. He is accustomed to work in the morning, and read in the afternoon. 11. He who fosters idleness, fosters sin also. 12. Cherish virtue and not wickedness. 13. He is not accustomed to rise before eight o'clock. 14. It is not the custom to say in America as in Germany, "I wish you a good appetite." 15. Man often troubles himself about his subsistence more than is necessary. 16. The ant takes care of its food in the summer against the winter. 17. The German emperor, Maximilian I., took care to restore the internal tranquillity of Germany directly on his accession to the government.

EXERCISE 121 (Vol. II., page 283).

1. Nehmt Euch vor denen in Acht, welche glatte Worte, böse Gedanken und ein falsches Herz haben. 2. Er sorgt mehr für seinen Geist als für seinen Körper. 3. Wir pflegen, anstatt des Kaffees, Thee zu trinken. 4. Die Griechen pflegten schon lange vor Christi Geburt der Kunst und Wissenschaft. 5. Er pflegt um sechs Uhr aufzustehen. 6. Ich werde dieses Buch in Acht nehmen, bis Sie wiederkommen. 7. Er pflegt seiner Gesundheit. 8. Habe Acht auf dich, nicht nur in Gesellschaft, sondern auch wenn du allein bist. 9. Gute Kinder geben Acht auf das, was ihre Eltern ihnen sagen. 10. Wir müssen uns vor unsern Feinden in Acht nehmen. 11. Der Hamster sorgt im Sommer für seine Nahrung auf den Winter.

EXERCISE 122 (Vol. II., page 315).

1. Those who go walking too often, at last accustom themselves to idleness. 2. To take a walk half an hour after dinner is very conducive to health. 3. In Italy many drive out with mules. 4. One generally sees more gentlemen walking, than riding on horseback. 5. The visitors (literally, guests under cure) at Wiesbaden often ride on mules upon the top of the Taunus mountains. 6. Journeys on foot are often more agreeable than in a coach or on horseback. 7. The Laplanders ride in sledges, and make use of reindeer instead of horses. 8. He scarcely took his eyes off his relations, whom he had not seen for so long a time, and rejoiced at their communications. 9. Most of the officers have interceded with the general for this young soldier. 10. I applied to my friends in my troubles; but wherever I turned, I saw only indifferent looks. 11. He stole my watch and some other articles without my observing it. 12. He who prides himself on his knowledge, thereby proves that he knows less than he boasts and wishes to make others believe. 13. I hope you will not suppose I offended you purposely? 14. God forbid! I never did or would believe anything so bad of you. 15. I hope you will not remain at home during this beautiful weather. 16. Oh, no! I have no inclination to spend such a beautiful day within the four walls of my room. 17. There are several who have applied for this office, viz., the following. 18. I cannot help telling you that this treatment does not please me. 19. I cannot help thanking you very heartily. 20. When I wished to shoot at the wolf my gun missed fire.

EXERCISE 123 (Vol. II., page 315).

1. Er konnte nicht umhin, seinen Tadel auszusprechen. 2. Bewahre was, o Herr, vor Sünde. 3. Ich konnte nicht umhin, das Unrecht, welches ich erlitten hatte, zu vergeben. 4. Indem er dieses sagte, sank er ohnmächtig nieder. 5. Wie werden langsam nach dem Parke reiten. 6. Die Königin ritt gestern spazieren. 7. Dieser Kaufmann that groß mit seinen Reichthümern. 8. Der Arbeiter reitet mit unglaublicher Schnelle. 9. Wenn die alten Kitter in den Krieg ritten, so waren ihre Pferde gepanzert. 10.

Könige und Fürsten pflegen mit sechs Pferden spazieren zu fahren. 11. Als er hätte entfliehen können, versagten ihm seine Kräfte. 12. Das Holz wird zum Bauen verwendet. 13. Er hat den größten Theil seiner Jugend auf wissenschaftliche Studien verwendet. 14. Reisen durch das Rheinthal sind angenehmer zu Fuß als zu Pferde. 15. Johann führt seine Schwester durch den Park spazieren, während ihr Vater spazieren reitet.

EXERCISE 124 (Vol. II., page 315).

1. The physician has advised me to go out as little as possible. 2. Emily works as little as possible, in order to preserve the delicacy of her hands. 3. Children should be unemployed as little as possible at any time. 4. He speaks so little, in order to excite no attention. 5. Ferdinand is now very little at home. 6. On my last journey I had very little luggage with me. 7. Will you have some meat? 8. Yes, but only very little. 9. There remains nothing else for him but to beg or to work. 10. There remains nothing else, you must act now. 11. Of all his property, there remained nothing else for him but a spot of land. 12. Of all the flowers, this rose only remained. 13. Of the whole regiment, he only remained. 14. I cannot get rid of these sorrowful thoughts. 15. In order to get rid of our false friends, we must lend them money. 16. Grant him his request, in order to get rid of him. 17. Now the sport commenced afresh. 18. The plaster of the wall breaks off. 19. When the war re-commenced, he took the field with a great army. 20. The gun went off as he was going to take it.

EXERCISE 125 (Vol. II., page 315).

1. Der Arzt rath meiner Schwester, so viel als möglich zu Hause zu bleiben. 2. Ein Lehrer sollte seine Schüler so wenig als möglich unbeschäftigt lassen. 3. Der Reiter sprach mit großer Begeisterung, um die Aufmerksamkeit seiner Zuhörer zu steigern. 4. Die meisten Reisenden nehmen so wenig Gepäck als möglich mit sich. 5. Wollen Sie Mepel haben? 6. Ich kante Jönen, mein Herr, ich habe ganz genug. 7. August ist jetzt sehr viel zu Hause, daher können wir zu ihm gehen. 8. Es bleibt ihm nichts übrig, als sich seinem Schicksale zu unterwerfen. 9. Es blieb mir nichts Anderes übrig, als vor dem Feinde zu fliehen. 10. Von all seiner Habe blieb nichts übrig, als ein Garten. 11. Ich kann meinen Schnupfen nicht los werden. 12. Gewähre die Bitte dieses falschen Freundes, dann wirst du ihn los werden. 13. Wer hat den Fuß dieses Fisches abgetrennt? 14. Die Magd brach ihn ab, als sie das Zimmer reinigte. 15. Friedrich der Große zog an der Spitze seiner Armee in den Krieg. 16. Das Gewehr ging los, sonst würde er den Haken geschossen haben.

EXERCISE 126 (Vol. II., page 340).

1. The French conquered Spain by force of arms. 2. The avalanches in Switzerland often fall into the valleys with tremendous force. 3. They forcibly drag away the inhabitants of this country. 4. He could do nothing with all his power. 5. The Greeks defended themselves against the Persians with all their might. 6. The weaker man must necessarily obey the stronger. 7. Almost all Asia obeyed the will of the Romans. 8. In order to prolong his life, he was necessarily obliged to work. 9. Themistocles was forced to seek an asylum at the Persian court. 10. My friend confidentially entrusted me with an important secret yesterday evening. 11. After school was over, the children played under the trees of the garden. 12. All present dressed according to the fashion of 1789. 13. On account of his official duties, he had little leisure left for pleasure. 14. Schiller could now devote himself at his leisure to literary pursuits at Mannheim. 15. I have inadvertently taken another umbrella. 16. Errors arise through misunderstandings and oversights. 17. Fortunately he could prove himself right by means of his passport. 18. Fortunately I had discovered the danger, yet at the right time. 19. Fortunately I met him in the street. 20. Fortunately no human life has been lost at this great conflagration. 21. In jest, a person may take many liberties. 22. He alluded to this scene in a jocular way. 23. I am particularly fond of the French language. 24. He was allowed to enter the prince's room without special permission.

EXERCISE 127 (Vol. II., page 340).

1. Die Gimmelner Hölle's vertheiligten sich mit all ihrer Macht gegen die Dänen. 2. Wilhelm der Eroberer unterjochte England mit Gewalt der Waffen. 3. Diese tapfern Soldaten kühnten sich ihren Weg mit furchtbarer Gewalt durch die Reihen der Feinde. 4. Man hinterste ihn gewaltsam an der Flucht. 5. Lieben Sie die deutsche Sprache? 6. Ja, ich liebe sie, aber vorzugsweise liebe ich die italienische Sprache. 7. Jetzt ist er besonders mit der deutschen und französischen Sprache beschäftigt. 8. Glücklicher Weise fand ich meinen Freund zu Hause. 9. Er ist geneigt, den Befehlen seiner Vorgesetzten zu gehorchen. 10. Die meisten Leute kleiden sich nach der französischen Mode. 11. Ich nahm unwillkürlich den Hut eines Andern. 12. Glücklicher Weise entdeckte mein Freund die Gefahr, welche ihm drohte. 13. Scherzweise sagte er mir manche Wahrheit. 14. Unter vier Augen können Sie manche Veleibungen sagen. 15. Die Fürsten Deutschlands versahen eigenmächtig in Regieren ihrer Länder.

LESSONS IN BOTANY.—XXXII.

SECTION LXXXV.—MALVACEÆ, OR MALLOW-WORTS.

Characteristics: Calyx free; valvate in aestivation; petals hypogynous, ordinarily slightly joined together at the base; contorted in aestivation; stamens indefinite, monadelphous, with uni-locular anthers; seed dicotyledonous; embryo curved; leaves alternate, stipulate.

Stem herbaceous or ligneous, usually supplied with radiating hairs; flowers complete, regular, axillary, solitary, or fasciculate, or in a cyme; pollen in large grains, globular, hispid; carpels ordinarily numerous, sometimes five; verticillate around a prolongation of the floral axis, sometimes agglomerated into a capsule, either free or partially coherent. Ovules inserted into the central angle of the cells, ascendant or horizontal, curved.

The styles are free above. Fruit sometimes formed of many shells coherent by their margins to a variable extent; sometimes a loculicidal capsule with septiferous valves, sometimes indehiscent, dry, or fleshy.

The cotyledons are bent or mutually twisted. Albumen fleshy or none.

The *Malvaceæ* abound in the tropics, their number diminishing towards either pole; their chief property depends on a mucilage which abounds in the greater number, whence the *Malvaceæ* are celebrated for their emollient properties. In certain species there exists, in addition to the mucilage, a free acid, generally the oxalic, the presence of which causes them to be refrigerant, antibilious, and antiscorbutic. The seeds contain a fixed oil. Some species possess tenacious fibres, others seeds which are covered with a substance resembling wool.

Among the indigenous species of this tribe the marsh mallow (*Althæa officinalis*, Fig. 240) is most common.

The plants of the Cotton sub-family (*Gossypium*, Fig. 241, 242), which belongs to this natural order, are indigenous to Asia and America. Many species are now cultivated on a large scale in every part of the intertropical zone. The laniferous material which envelopes the seeds is the substance cotton. It has been known and used in Egypt from times of great antiquity, and is now distributed over the whole world. Several remains of Greek literature have been handed down to us written on cotton. Cotton seeds yield on expression a fixed oil useful for a variety of purposes.

Numerous foreign *Malvaceæ* are now cultivated in Europe; for example, the *Malope trifida*, an annual of Northern Africa, the stem of which rises to the height of about two feet, and which bears flowers of a deep-rose colour; the *Kitaibelia*, a biennial Hungarian plant, having lobed leaves and white flowers; the hollyhock, or *Althæa rosea*, a Chinese plant, the varieties of which are extremely numerous; the tree mallow, or *Lavatera arborea*, a native of France, &c., bearing large leaves and violet-coloured flowers; and the hemp-leaved althæa

(*Althæa cannabina*), a native of various parts of Central Europe, which has purple flowers, and the stem of which yields a good substitute for hemp. Such are a few of the species of this natural order now familiar in gardens.

SECTION LXXXVI.—GERANIACEÆ, OR CRANESBILLS.

Characteristics: Calyx free; petals hypogynous or imperfectly perigynous, in number equal to the sepals or fewer; equal in *Geranium*, reduced to four or two in *Pelargonium*; contorted in aestivation, caducous; stamens ordinarily double in number to the petals; bi-serial; all fertile (*Geranium*) or partly sterile (*Erodium*, Fig. 243; *Pelargonium*, Fig. 244), filaments partially monadelphous; carpels five, applied to the prolongation of the axis, and constituting a five-celled bi-ovulate ovary; seed dicotyledonous, exalbuminous, curved; cotyledons bent or contorted; stem herbaceous or ligneous; leaves stipulate, opposite; the upper ones sometimes alternate; flowers complete, regular, or irregular (*Pelargonium*), occasionally solitary, arranged sometimes in twos; styles joined into a column, which is longer than the floral axis; ovules ascendant, at first curved, then demi-reflexed.

Species of this natural order are chiefly found in the extra-tropical regions, more especially at the Cape of Good Hope; they contain tannic and gallic acids, on which account they were formerly employed as astringents in medical practice. The *Pelargoniums* contain a volatile oil, which imparts to them a very powerful but at the same time agreeable odour. The *Pelargonium roseum* and *Pelargonium capitatum* yield an essence possessing the odour of roses, which is sometimes employed as a material wherewith otto of roses is adulterated.

SECT. LXXXVII.—BALSAMINACEÆ, OR BALSAMS.

Characteristics: Sepals free, unequal, petaloid; petals five hypogynous, unequal; stamens five; carpels five, united to form a five-celled ovary; ovules superior, pendent, reflexed; capsule five-celled, five-valved, dehiscent; seed dicotyledonous, exalbuminous; embryo straight; stem herbaceous, succulent; flowers axillary.

The *Balsaminaceæ* are for the most part natives of temperate and tropical Asia. The genus *Impatiens*, so called on account of the elasticity of its seed-capsules, which, on being touched, dart out the seeds to a considerable distance, has furnished numerous varieties to horticulture. The common balsam plant, *Impatiens balsamina*, is an annual, a native of India, now rendered double by culture, and furnishing innumerable varieties. The *Impatiens repens* is a Cingalese species, the representation of which is subjoined (Fig. 245). It has only been recently introduced into European culture.

SECTION LXXXVIII.—TROPEOLACEÆ, OR INDIAN CRESSES.

Characteristics: Calyx five-partite, bi-labiate, petaloid; petals five, unequal, inserted at the base of the calyx; stamens eight,



239. THE INDIAN CRESS (TROPEOLUM).

1, Section of flower of the tropæolum; 2, stamen; 3, lower petal, with a hair-like fringe at base; 4, upper petal; 5, fruit; 6, fruit, with one of the lobes taken away, and another bisected to show seed.

hypogynous; ovary three-celled, uni-ovulate; ovules pendent, reflexed; fruit succulent or dry, composed of three shells, sometimes winged; seed dicotyledonous; embryo exalbuminous, straight; stem herbaceous, succulent, diffused or voluble; leaves peltate, the inferior leaves opposite and stipulated,

yellow flowers of no great beauty, and belong to an entirely different order, namely, that of the *Brassicaceæ*, or *Crucifera*.

SECTION LXXXIX.—LIMNANTHACEÆ.

Characteristics: Calyx free; petals inserted upon an



240. MARSH MALLOW (ALTHÆA OFFICINALIS). 241. COTTON PLANT (GOSSYPIMUM). 242. SECTION OF FLOWER OF COTTON PLANT. 243. HERON'S BILL (ERODIUM). 244. STORK'S BILL (PELARGONIUM). 245. CREEPING BALM (IMPATIENS REPENS). 246. PINK LIMNANTHES (LIMNANTHES ROSEA).

the superior leaves alternate and without stipules; flowers axillary.

The *Tropæolaceæ* inhabit the entire of Central America. The genus *Tropæolum* (Fig. 239) is cultivated in Europe. The *Tropæolum speciosum*, a native of Patagonia, bears a handsome scarlet flower. The Indian cress, with its broad, buckler-like leaves and flowers of all shades, from the faintest primrose to a rich crimson brown, is often erroneously called nasturtium. The real nasturtiums are hardy aquatic plants, bearing

almost perigynous disc, three or five equal; aestivation convolute; stamens six or ten; carpels three or five, coherent, uni-ovulate; ovules erect, reflexed; fruit composed of two or three achenia; seed dicotyledonous, exalbuminous; embryo straight.

The members of this natural order are indigenous to North America, generally annuals, growing in marshy places; their leaves soft and glistening, alternate, their flowers regular. The *Limnanthes rosea* (Fig. 246) is a native of California. This

small natural order is placed by Lindley with the *Tropaeaceae*, with which it agrees in many particulars. It differs from it, however, in having regular flowers, perigynous stamens, and erect ovules.

LESSONS IN ENGLISH.—XXXIII.

LATIN STEMS (continued).

If words degenerate, they also improve. As a nation refines, its thoughts refine. What, therefore, was originally material becomes intellectual. The intellectual, too, may pass into the moral, and the moral may be elevated into the spiritual. Our most purely spiritual terms were all physical in their origin. What a wide difference there is between *birth* and the *new birth*; between *generation* and *regeneration*. *Spirit* in its original Latin is merely *breath* or *breathing*. Heaven, the state of spiritual blessedness, if viewed derivatively, is merely the *heaved-up* place, as *hell* is the covered place; *hell*yer is still used in some parts of England for a *coverer*—that is, a tiler or slater, a house-coverer. And what is *virtue*? Originally, but the quality of *vir*—that is, a man! And what was that quality? *Valour*; he was emphatically *the man who was most brave*.

Happy, too, is a word which has undergone a favourable transformation. You see its primitive meaning in *happen* and *mis-hap*. *Hap*, originally, was applied to a good or a bad event, signifying *occurrence* merely. But in this world of goodness, the general tenor of events is such as to promote men's good; hence to receive its *haps* is to be *happy*, and to be exceptional in regard to its *haps* is to be *unhappy*—

"Such *happes* which *happen* in such *hapless* warres,
Make me to term them *broyles* and *beastly larres*."

Gascoigne.

There are words represented as of recent origin which may claim some age. The word *Rationalist* owes not its birth to the influence of recent German philosophy, but was used under the Commonwealth to designate a sect then new which idolised reason. Nor is the term *Christology* of German origin, but seems to have been invented by Dr. Thomas Jackson in the seventeenth century. The verb *to progress* is often disallowed as an Americanism, but it is found in Shakespeare:—

"Let me wipe off this honourable dew
That silverly doth *progress* on thy cheeks."

"King John," Act. v. Sc. 2.

LATIN STEMS.

Latin Words.	Meanings.	Stems.	English Words.
Mel (mellis)	honey	melli	mellifluous.
Mellior	better	mellior	melliorate, amelioration.
Memor	mindful	memor	memorable, memorial.
Mens (mentis)	the intellect	ment	mental, demontate.
Mergo	I plunge	merg	immerge, emerge.
Mersus	plunged	mers	immersion, emersion.
Metior	I measure	met	meto, meter, meteyard.
Mensus	measured	mensu	commensurate, mensuration.
Mille	a thousand	mill	millennium, millenary.
Mirror	I gaze, wonder	mir	mirror, admire.
Miser	wretched	miser	miserable, a miser.
Mitis	mild	miti	mitigate.
Mitto	I send	mit	remit, commit, permit.
Missus	sent	miss	missionary, missive.
Modus	a measure	mod	mode, modify.
Mola	a millstone	mol	emolument, molar.
Moles	a mass	mol	demolish, a mole.
Molestus	troublesome	molest	molestation.
Mollis	soft	mollis	mollify, emollient.
Moneo	I warn	mon	admonish.
Monitus	warned	monit	monitor.
Mors (mortis)	death	morti, mort	mortify, immortal.
Mos (moris)	a manner	mor	moral, moralist.
Multus	many	multi	multiform, multitude.
Munitus	fortified	munit	munitio, ammunition.
Munus (muneris)	a gift	muner	remunerate.
Murus	a wall	mur	immure, mural.
Muto	I change	mut	mutable, commute.
Natus	born	nat	native, natal.
Navis	a ship	nav	naval, navigate.
Agro	I drive	ag	agile, agitate.
Necto	I tie, bind	nect	connect, disconnect.
Nexus	a bond	nex	anner, connexion.
Nego	I deny	neg	negative, negation.
Nihil	nothing	nihil	annihilate, nihility.
Nomen (nominis)	a name	nomin	nominal, denominate.

Non	not	non	nonentity, nonage
Norma	a rule	norm	enormous, normal.
Novus	new	nov	novice, innovate.
Nox (noctis)	night	nox, noct	equinox, nocturnal.
Nubo	I marry	nub	connubial.
Nuptus	married	nupt	nuptials.
Nudus	naked	nud	nudity, denude.
Nugæ	trifles	nug	nugatory.
Numerus	a number	numer	numeration, innumerable.
Nuncio	I tell	nunci, nunc	annunciation, renounce.
Nutrio	I nourish	nutri	nutriment, nutritious.
Octo	eight	oct	octagon, octave.
Oculus	an eye	ocul	oculist, ocular.
Oleo	I smell	ol	olfactory, redolent.
Omnis	all	omni	omnipresent, omnibus.
Onus (onēris)	a burden	oner	onerous, exonerate.
Opto	I wish	opt	adapt, option.
Opus (opēris)	work	oper	operose, operation.
Orbis	a circle	orbis	orbicular, orbit.
Orno	I deck	orn	ornament, adora.
Oro	I beg	ora	oration, orator.
Os (oris)	the mouth	or	oral, adoration, orifice.
Os (ossis)	a bone	oss	ossify, osseous.
Otium	ease	oti	otiose, negotiate.
Ovum	an egg	ov	oval, oviform.
Pactus	having agreed	pact	compact, pact, paction.
Pando	I spread	pand, pans	expand, expanse.
Pausus (passus)	spread	pass	compass, to pass.
Par	equal	par	parity, imparity.
Pareo	I appear	par	apparent.
Parco	I bring forth	par	parent, viviparous.
Vivus (vivi)	alive	vivi	vivify, vivid.
Paro	I prepare	par, pair	reparation, repair.
Pastus	fed	past	repast, pasty.
Pater	a father	pater, patri	paternal, patrimony.
Pator	I suffer	pati	parricide.
Passus	suffered	pass	patient, impatient.
Pauci	few	pauci	passive, passion.
Pax (pacis)	peace	paci	paucity.
Pecco	I sin	pecc	pacify, pacific.
Pectus (pectōris)	the breast	pector	impeccable, peccadillo.
Peculium	private property	pecul	expectorate.
Pecunia	money	pecun	peculation.
Pello	I drive	pel	pecuniary.
Pulsus	driven	puls	expel, impel.
Pendo	I hang, weigh	pend	repulsion, expulsion.
Pensus	hung	pens	depend, pendulum, stipend.
Pene	almost	pen	pensive, compensate.
Peto	I seek, aim at	pet	peninsula.
Centrum	a centre	centr	centripetal, competition.
Pictus	painted	pict	central, centrifugal.
Piscis	a fish	pisc	depict, picture.
Placidus	pleasing	placid	piscatory.
Placo	I appease	plac	placid, placially.
			placable, implacable.

The word *nonentity* recalls the days of the schoolmen, or monkish philosophers of the Middle Ages, who subtly, profoundly, and perseveringly speculated on metaphysical topics, striving to invest the dogmas of the Church with a philosophical dress and certitude. *Entity* or *being*, and *nonentity* or *no-being*, were among the counters with which they played their clever intellectual game; which, like most other games, secured little else than amusement.

"Fortune is no real entity, nor physical essence, but a mere relative signification."—Bantley.

"With real *munition* he did fortify
His heart."—Daniel.

"They must have the assistance of some able military man, and convenient arms and *ammunition* for their defence."—Bacon.

The word *adoration*, etymologically considered, signifies a kissing of the mouth to a visible object of worship—in token of reverence and as expressive of worship.

The term *peculation* means the making of that your own which is not your own. *Peculation*, as derived from *peculium*, private property, wears a socialist aspect, and seems to say, "la propriété c'est le vol;" that is, "private property is plunder," a truly monstrous and anti-social doctrine.

"A real circular motion is always accompanied with a centrifugal force, arising from the tendency which a body always has to proceed in a right line."—Maclaurin. "Account of Newton's Philosophical Discoveries."

LATIN STEMS.

Latin Words.	Meanings.	Stems.	English Words.
Plebs	the common people	pleb	plebeian.
Plenus	full	plen	plenitude, replenish.
Pleo	I fill	ply, plet	supply, complete, expletive.
Plico	I fold	plic	complicated.
Ploro	I wail	plor	deplore, implore.
Plumbum	lead	plumb, plum	plumber, plummet.
Pono	I place	pon	depono, exponent.
Positus	placed	pos, posit	impose, position.
Populus	the people	popul	popular.
Porto	I carry	port	portable, export.
Poto	I drink	pot	potion, potable.
Praeda	plunder	preda	predatory, depredation.
Pravus	wicked	prav	depravity.
Precor	I pray	prec	deprecate, imprecate.
Prehendo	I take hold of	prehend	apprehend.
Prehensus	taken	prehens	apprehension.
Pretium	a price	preci	appreciate.
Probo	I prove	prob	probable, probation.
Probus	good	prob	probability.
Pudens (pudentis)	modest	pudent	impudent.
Puer	a boy	puer	puerile.
Pugna	a fight	pugn	pugnacious, impugn.
Puto	I prune, put in order, think	put	amputate, reputation, dispute.
Putris	rotten	putr	putrefaction, putrid.
Quero	I seek, ask	quir, quer	query, inquire.
Quæsitus	asked	quisit	question, inquest.
Quassus	shaken, agitated	quest	inquisition, requisition.
Quatuor	four	quat, quadr	discuss, percussion.
Angulus	a corner	angl, angul	quaternion, quadrangle.
Queror	I complain	quer	angle, angular.
Quinque	five	quingu	querulous.
Radix (radicis)	a root	radio	quingennial.
Ramus	a branch	ram	radical, eradicate.
Rasus	scraped	ras (raz)	ramification.
Ratio (rationis)	reason	rat	erase (razor).
Rectus	straight	recti	rational, rate.
Linea	a line	line	rectilinear, rectify.
Rego	I rule	reg	linear, lineament.
Rectus	ruled	rect	regal, regulate.
Reti	a net	reti	rector, director.
Rideo	I laugh	rid	reticulate, retina.
Risus	laughed at	ris	deride, ridicule.
Rigo	I water	rig	risible, derisive.
Rodo	I gnaw	rod	irrigate.
Rosus	gnawed	ros	corrode, erode.
Rota	a wheel	rota	corrosion, erosion.
Rumen (ruminis)	the gullet	rumin	rotation, rotary.
Ruptus	broken	rupt	ruminate.
Rus (ruris)	the country	rus, rur	bankrupt, eruption.
Sacer (sacri)	sacred	sacri, sacer	rustic, rural.
Sal (salis)	salt	sali	sacrifice, sacerdotal.
Salio	I leap	salit	saline.
Salvus	leapt	sault, sult	salient.
Sanctus	safe	salo	assault, insult.
Satis	holy	sanct	salvation, salvage.
Satur	enough	satis, sati	sanctify, sanctuary.
Satur	full	satur	satisfy, satiate.
Scando	I climb	scend	saturate.
Scindo	I cleave	scind	ascend, descend.
Scio	I know	sci	rescind.
Scribo	I write	scrib	science, prescience.
Scriptus	written	script	scribe, inscribe.
Scrutor	I search dili- gently	scrut	scripture, postscript.
Scurra	a scuffer	scurr	scrutiny, inscrutable
Sectus	cut	sect	scrutiny.
Sedo	I sit	sed, sid	dissect, sectarian.
Sessus	seated	sess	sedentary, preside.
Semen (seminis)	seed	semin	session.
Semi	half	semi	dissimulate, seminary.
			semicircle, semicrowl.

Expletives are words not needed for the sense, but used merely to fill up and round off the sentence. Of course expletives are to be avoided:—

"While expletives their feeble aid do join,
And ten low words oft creep in one dull line."—Pope.

The term *depono*, in law phraseology, is used by the Scotch where we use *depose*. The distinction is arbitrary, for we speak

of the *deponent* while we say he *deposes*, not *depones*; though of old *depones* was used in England:—

"And further Sprot *deponeth*," etc.—"State Trials."

The *retina*, or eye-net, the immediate seat or rather instrument of vision, is the net-like expansion of the optic nerve, on which objects are drawn, and from which they are made visible by the mind.

Reticulated denotes that which is made like net-work. Hence the meaning of *reticule* or *little bag made of net-work*, some time since much in use among ladies.

To *ruminate* is to pass and repass the food through the rumen or gullet in order to its repeated chewing. Hence the phrase *to chew the cud*. Metaphorically, to *ruminate* is to muse, to reflect calmly:—

"As when a traveller, a long day past,
In painful search of what he cannot find,
At night's approach, content with the next cot,
There *ruminates* awhile his labour lost."

In prose we say to *ruminate on*, that is, to meditate upon:—

"He practises a slow meditation, and *ruminates* on the subject."—Watts, "On the Mind."

Bankrupt, a term of French extraction, properly denotes a trader or money-dealer whose bank or bench is broken, the last condition of commercial destitution:—

"A bankrupt is defined a trader who secretes himself, or does certain other acts tending to defraud his creditors."—Blackstone.

The terms *rustic* and *rural* differ in their application, the first being said of persons, the second of things. *Rustics* are often insensible to the loveliness of *rural* scenes.

COMPOSITION.

Form into a sentence each of these with their proper prepositions:—

Words.	F. R.
Confide in,	fido, I trust.
Conform to,	forma, form.
Congenial with,	genus, kind.
Congratulate on,	gratular, I congratulate.
Connect with,	necto, I bind.
Conscious of,	scio, I know.
Consecrate to,	sacer, sacred.
Consent to,	sentio, I feel, think.
Consign to,	signum, a sign.
Consist of, in, with,	sto, I stand.
Consistent with,	
Consult, and consult with,	consul, a counsellor.
Contend with, against,	tendo, I stretch.
Contiguous to,	tango, I touch.
Contrast with,	traho, I draw.
Contrary to,	contra, opposite.
Conversant in, with, about,	versor, I am engaged in.
Convert to, into,	verto, I turn.
Convict of,	
Convince of,	vinco, I overcome.
Copy from, after,	copie, a transcript.
Correspond to, with,	respondeo, I answer.
Covenant with, for,	venio, I come.
Care of,	cura, care.

To *consist of*, to *consist in*, and to *consist with*, have each a different meaning. To *consist of* has reference to the materials of which an object is made up; to *consist in* has reference to the substance or essence of a thought; to *consist with* has reference to the character or dignity of an agent or actor. It consists with the character of a wise man to expound doctrines in which the welfare of his fellow-men consists: that exposition he makes by words which consist of sounds, or by books which consist of letters. The wealth of a nation consists not so much in the number as the heart, the intelligence, and the sinews of its inhabitants.

LESSONS IN CHEMISTRY.—XXIII.

METALS PROPER—continued.

CHROMIUM.

SYMBOL, Cr—COMBINING WEIGHT, 52.5.

The chief ore of this metal is *chrome iron-stone*, whose composition ($\text{FeO}, \text{Cr}_2\text{O}_3$) is similar to that of magnetic iron ore, but where the sesquioxide of iron is replaced by the corresponding oxide of chromium. The metal may be reduced from its

chloride by carbon at a high heat, or by sodium. It proves to be most difficult of fusion, even more so than platinum. When obtained by the latter process, it appears in crystals of the first system. It is only of value on account of the colour of its oxides and salts, which are used as pigments.

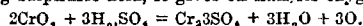
The oxides of chromium are four:—Chromous oxide (CrO); chromic oxide (Cr_2O_3); an intermediate oxide, which may be considered as a compound of the CrO and Cr_2O_3 ; and the only acid oxide, chromic acid (CrO_3).

Chromous Oxide is only obtainable as a hydrate. When caustic potash is added to a solution of chromous chloride, it falls as a brown powder.

Chromic Oxide is a sesquioxide (Cr_2O_3). When ammonia is added to a solution of chromic chloride, this oxide falls as a hydrate. When heated to render it anhydrous, it becomes a green powder, which is used as a paint. Chromic oxide forms two sets of salts—one green, which is amorphous; the other violet, which crystallises. The emerald owes its colour to the presence of this oxide.

Chromic Acid (CrO_3) may be obtained in many ways—one is by mixing four measures of the solution of potassium bichromate with five of sulphuric acid. As the mixture cools, the oxide separates out into crimson needles. It exhibits an acid reaction, forming with bases *chromates*, which are yellow or red salts. Neutral chromates are yellow, as potassium chromate ($\text{K}_2\text{O}, \text{CrO}_3$). Potassium bichromate ($\text{K}_2\text{O}, 2\text{CrO}_3$) is the salt chiefly manufactured, and from which the various pigments are derived. It exists in large red transparent four-sided tables.

"Chrome Yellow" is lead chromate (PbO, CrO_3), and is procured by precipitation from a dilute solution of lead acetate by a solution of potassium bichromate. When chromic acid is heated with strong sulphuric acid, it gives off half its oxygen, thus—



"This mixture affords one of the most powerful means of oxidising carbon at comparatively low temperatures." (Williamson.) The chromic sulphate formed in this reaction is the compound which forms with potassium and ammonium sulphates a series of alums.

A peculiar dark strongly-fuming liquid is obtained when a mixture of a chromic salt, sodium chloride, and sulphuric acid is heated. It comes off as a red vapour, and may be considered as chromic acid, where one atom of the oxygen has been replaced by its equivalent two atoms of chlorine. Hence its formula is CrO_2Cl_2 , and its name *chloro-chromic acid*.

There are two known chlorides—chromous chloride (CrCl_2), and chromic chloride (CrCl_3). The latter is obtained as violet-coloured scales, when a current of dry chlorine is passed over an intimate mixture of chromic oxide and charcoal heated to redness. This variety is insoluble; but it becomes green and loses its insolubility when a very small quantity of the chromous chloride is added to it suspended in water, or the soluble chloride is more readily obtained by boiling the solution of a chromate with hydrochloric acid and alcohol.

The chromous chloride is a white powder procured by heating the chromic chloride in a current of hydrogen. The other salts of this metal do not present any great interest.

Chromic oxide imparts to glass or a borax bead a good green colour. The salts of chromium give insoluble precipitates with lead and silver compounds, of a yellow colour. All the chromates, when treated with dilute sulphuric acid and a little alcohol or sugar (organic matter), become reduced to the green oxide of chromium.

URANIUM.

SYMBOL, U—COMBINING WEIGHT, 120.

The chief ore of this rare metal is *pitch-blende*. The metal is of a whitish colour, and does not oxidise when exposed to the air; but if heated in air, it burns vividly. Two oxides are known, and both are used in glass-staining.

Uranous Oxide (UO), or the protoxide of this compound, appears analogous to chromous oxide. When heated in a current of hydrogen, it refuses to give up its oxygen. If this oxide be heated to bright redness, and then suddenly cooled, the intense black is furnished with which porcelain is coloured and glass stained black.

Uranic Oxide (U_2O_3) is a yellow powder which is soluble in mineral acids and ammonium carbonate. This peroxide imparts to glass that peculiar yellow-greenish tint which characterises uranium glass, which is also remarkable for its fluorescence.

ARSENIC.

SYMBOL, As—COMBINING WEIGHT, 75.

Arsenic is considered a non-metallic element by certain French chemists, on account of its striking analogy to phosphorus and nitrogen; but seeing that it conducts electricity readily, and possesses a metallic lustre, it is generally classed among the metals. Probably its true place is between the classes, being the "transition" element. Like phosphorus, its vapour offers an exception to the rule. Its density, instead of being represented by its combining number, is just double, or 150. This may be expressed by saying, that the volume occupied by an atom of arsenic in its gaseous condition is just one-half that of the other elements. The reason of this has not yet been discovered. The metal occasionally is found native, but generally as an alloy with iron, cobalt, nickel, etc. "Realgar" is the sulphide, and "orpiment" the tersulphide, both of which are rare minerals. The metal is chiefly obtained from *mispickel*, an arsenical sulphide of iron. The fumes from the furnace are conducted into chambers where arsenious acid (As_2O_3) is condensed. When heated with charcoal, this oxide is reduced, and the metal which vaporises is got by condensation. It has a brilliant steel-like lustre, and is very brittle. It refuses to melt, but readily volatilises, the vapours condensing on the first cold surface they meet into rhombohedra of the metal. The vapour of arsenic possesses a strong odour of garlic. When heated in air, the metal burns with a blue flame into

Arsenious Acid (As_2O_3).—This is the virulent poison "arsenic," the white arsenic of the shops. It is obtained from the ore, as already stated, as a crystalline white powder. When heated, it fuses into a semi-transparent vitreous mass, which gradually becomes opaque, like a piece of white porcelain. It is soluble in hot hydrochloric acid or hot ammonia, and these solutions, as they cool, deposit arsenic in transparent crystals. If the process be watched in a dark room, light is emitted as each crystal is formed. Arsenious acid is soluble in alkaline solutions, soluble arsenites being formed. When to such a solution in potash copper sulphate is added, the much-used pigment "*Scheele's green*" is precipitated.

When silver nitrate is added to the solution of potassium arsenite, the yellow silver arsenite ($3\text{Ag}, \text{AsO}_3$) falls. When a solution of arsenious acid is acidulated with hydrochloric acid, and sulphuretted hydrogen passed through it, the yellow arsenious sulphide is precipitated.

The best antidote for this violent poison is *magnesia*, which forms with it an insoluble arsenite, and thus the poison passes as a foreign substance through the body. Ferric oxide has the same effect.

Arsenic Acid (As_2O_5) is obtained by oxidising arsenious acid by an excess of nitric acid, and evaporating to dryness in a platinum vessel. It is more soluble than arsenious acid, but does not volatilise when heated, being decomposed into the lower oxide and oxygen. This acid, in forming arsenates, behaves as phosphoric acid, being tri-basic (H_3AsO_4), and one or two or all the atoms of the hydrogen may be replaced. Arsenic may be readily distinguished from arsenious acid by the red-brown precipitate it affords with silver nitrate. Its poisonous properties are even more decided than those of arsenic. The sulphides of arsenic have been mentioned. Realgar is made artificially by heating together 198 parts of arsenious acid and 112 of sulphur. It is one of the ingredients in "*white Indian fire*," which is a mixture of seven parts of sulphur, two of realgar, and twenty-four of saltpetre. Orpiment is the chief ingredient in *King's yellow*. There is a penta-sulphide also known. Arsenic combines with chlorine, bromine, and sodium, forming compounds of but little interest.

The Tests for Arsenic.—If a slip of clean copper-foil be immersed in a solution of arsenious acid in hydrochloric acid, a grey film of metallic arsenic is deposited on the copper.

Marsh's Test is:—Introduce the liquid suspected of containing the poison into a bottle in which hydrogen is being generated in the usual way. Set fire to the escaping gas, and if the flame burn blue, arsenic is present. When a cold surface is depressed into the flame, a film of metallic arsenic is found upon it.

The gas which thus burns is *Arseniuretted Hydrogen* (AsH_3), which corresponds to NH_3 and PH_3 . It is capable of condensation, and at -40° Cent. becomes a liquid. The gas is absorbed by copper sulphate, copper arsenide being precipitated. It is a deadly poison. The inhaling of a bubble has been attended

with fatal results. The metallic ring of arsenic, most conclusive of all tests, may be shown by using a tube of the shape of Fig. 52, which may be made out of the ordinary test-tube. Into



Fig. 52.

the bulb introduce the arsenic mixed with powdered charcoal and a little sodium carbonate. Upon heating this, the metal will deposit itself on the cool part of the tube.

ANTIMONY.

SYMBOL, Sb—COMBINING WEIGHT, 122—SPECIFIC GRAVITY, 6.71.

This metal is invariably procured from *grey antimony ore*, which is a native sulphide and tolerably abundant. To extract the metal, the ore is purified and reduced to coarse powder. It is then raised to a dull red-heat on the hearth of a reverberatory furnace, by which most of the sulphur is driven off, and a red mixture of tersulphide and antimonious oxide remains. This is mixed with one-sixth of its weight of powdered charcoal, and made into a paste with a strong solution of sodium carbonate. When submitted to heat in crucibles, the reduced metal collects at the bottom. Its colour is bluish-white, and it is very brittle. Like arsenic, if heated strongly, it takes fire in air, and readily ignites in chlorine. Hydrochloric acid has no effect on it; nitric acid converts it into a white insoluble oxide; whilst strong sulphuric acid, with the aid of heat, makes it a sulphate, sulphurous acid coming off. Type metal is an alloy of four parts of lead and one of antimony.

Antimonic Oxide (Sb_2O_3) may be prepared in a hydrated state by pouring a solution of the terchloride of antimony into one of sodium carbonate. Carbonic acid is given off, sodium chloride is formed, and antimonic oxide falls as a white powder. When this oxide is dissolved in cream of tartar, and the solution concentrated, crystals of *tartar emetic* are procured.

Antimonic Acid (Sb_2O_5) is the white powder formed by the action of nitric acid on metallic antimony before alluded to. It combines with the alkalis, forming antimonates. When heated to redness, antimonic acid parts with some of its oxygen, and thus the only other oxide of antimony is produced, which may be considered as a compound of the other two ($\text{Sb}_2\text{O}_3, \text{Sb}_2\text{O}_5$).

Arseniuretted Hydrogen (SbH_3) is produced exactly as arseniuretted hydrogen, and burns with a blue flame into antimonic oxide. If this gas be passed through a small glass tube heated to redness like arseniuretted hydrogen, it is decomposed, metallic antimony being deposited. This, however, can be distinguished from arsenic by heating it in the air; and the oxide thus formed will not dissolve in water as arsenious oxide will.

Terchloride of Antimony (SbCl_3) may be obtained by the action of chlorine or an excess of the metal. Water decomposes it into hydrochloric acid and a basic chloride which was known as the *powder of algaroth*.

Pentachloride or Pentachloride (SbCl_5) is produced by the action of chlorine on the terchloride. It is a fuming liquid. There are also two sulphides, Sb_2S_3 and Sb_2S_5 . The salts of antimony in acid solutions give a characteristic orange precipitate with sulphuretted hydrogen.

READINGS IN FRENCH.—VIII. UN BIENFAIT N'EST JAMAIS PERDU.

SECTION IV.

La nuit était devenue (a) si épaisse, qu'ils furent contraints (b) de s'arrêter. Dès que le jour parut (c), ils renouvelèrent leurs recherches, hélas! avec aussi peu de succès que la veille, quand tout à coup le son d'un cor se fit (d) entendre.

"D'où vient ce signal?" s'écria aussitôt M. Dérambert en prêtant une oreille attentive.

Une seconde fois le son du cor retentit.

"Ce bruit vient de l'habitation; courons tous, mes amis." À ces mots la troupe se dirige en toute hâte vers la maison. À peine (e) y furent-ils arrivés, qu'ils aperçurent le marchand ambulant dont (f) il est parlé au commencement de cette histoire. À cette vue, l'espoir qui s'était élevé dans le cœur du pauvre père fit place (g) à un amer désappointement.

"Hélas!" lui dit-il, "je croyais (h) que c'était mon petit Alfred qui nous était rendu."

"Pardonnez-moi, Monsieur, si j'ai interrompu (i) vos recherches," répondit le marchand; "mais si je l'ai fait, c'est que

je pensais peut-être pouvoir vous être utile dans cette douloureuse circonstance. Veuillez (j) je vous prie, me laisser faire; j'ai l'espoir que nous saurons (k) bientôt ce qu'est devenu votre enfant."

Auguste et Fanny étaient là; le marchand frappe dans ses mains, et aussitôt on entendit l'aboiement joyeux d'un beau chien de Terre-Neuve qui bondit à ce signal. C'était Moustache, qui s'en alla tout d'abord caresser les deux enfants qu'il reconnut (l), en tournant autour d'eux et ayant l'air de se rappeler qu'il y en avait (m) un troisième.

"Voilà qui va (n) bien," dit le marchand; "Moustache reconnaît les enfants; à son air inquiet, je vois qu'il s'étonne de ne point voir celui qui est absent." Veuillez me donner les derniers vêtements que le petit Alfred a portés.

Quand ces objets furent là, il les montra à son chien, les lui fit flairer; puis, prenant la maison pour centre d'un rayon, il décrivit (o) autour d'elle un cercle d'un quart de mille, en ordonnant à Moustache de quêter partout où il le menait. Le cercle n'était pas entièrement parcouru lorsque le chien se mit (p) à aboyer.

Le son de sa voix rendit une lueur d'espérance au père et à la mère, qui étaient inconsolables. Le chien, en suivant les émanations du corps de l'enfant, aboya de nouveau; chacun s'empressa de le suivre, mais on le perdit bientôt dans les bois. Ce fut un moment de terrible anxiété, car pendant une demi-heure environ, l'on n'entendit plus rien.

COLLOQUIAL EXERCISE.

- | | |
|---|--|
| 1. Ne faisait-il pas très-obscure? | 12. Que demanda-t-il au père? |
| 2. Quo firent-ils au point du jour? | 13. Que fit ensuite le marchand? |
| 3. Qu'entendirent-ils tout à coup? | 14. Qu'entendit-on aussitôt? |
| 4. Que dit M. Dérambert? | 15. Où s'en alla d'abord le chien? |
| 5. Qu'entendit-on encore? | 16. Que dit le marchand de l'air inquiet du chien? |
| 6. Qu'ajouta M. Dérambert? | 17. Que demanda-t-il? |
| 7. Que fit alors la troupe? | 18. Que fit-il de ces objets? |
| 8. Qu'aperçurent-ils en arrivant? | 19. Quelles préparations fit-il ensuite? |
| 9. Que se passa-t-il alors dans le cœur du pauvre père? | 20. Que fit alors le chien? |
| 10. Que dit le père en reconnaissant le marchand? | 21. Quel fut l'effet de la voix du chien? |
| 11. Quelle excuse offrit le marchand? | 22. Put-on suivre le chien dans le bois? |

NOTES.

- | | |
|---------------------------------|---------------------------------------|
| (a) From devenir. | (i) From interrompre. |
| (b) From contraindre. | (j) Veuillez, have the goodness to. |
| (c) From paraître. | (k) From savoir. |
| (d) Se fit entendre, was heard. | (l) Reconnaît, saw, from reconnaître. |
| (e) À peine, scarcely. | (m) Il y en avait, there was. |
| (f) Dont, of whom. | (n) From aller. |
| (g) Fit place, gave way. | (o) From décrire. |
| (h) From croire. | (p) Se mit, began. |

SECTION V.

Le front du marchand était soucieux; renfermé dans un silence que personne ne songeait (a) à interrompre, il s'était mis (b) le visage contre terre et recueillait (c) les moindres bruits que la brise apportait. Tout à coup on le vit (d) tressaillir.

"Le chien revient," s'écria-t-il, "dans un instant il sera près de nous et nous saurons le résultat de sa course."

Quand le chien reparut, (e) sa contenance était visiblement changée, un air de gaieté et de satisfaction semblait l'animer; ses yeux brillaient, ses oreilles étaient droites; il frémissait, tous ses gestes indiquaient que ses recherches n'avaient pas été infructueuses.

"Je suis sûr qu'il a retrouvé l'enfant," fit (f) son maître.

"Mais vit-il (g) encore?" s'écria la mère.

Le marchand remua la tête et s'élança sur les traces de son chien, qui avait repris sa course à travers la forêt, en s'arrêtant de temps à (h) autre pour donner à son maître le temps de le rejoindre. Enfin l'animal s'arrêta au pied d'un gros arbre, et poussa (i) un long aboiement. Le marchand redoubla de vitesse, et bientôt il fut à côté de lui. Il aperçut (j) alors l'enfant couché sur un tas de feuillage et ne donnant aucun signe de vie. Il le prit (k) dans ses bras et reconnut (l) qu'il n'était pas (m) mort, mais seulement dans un état de faiblesse tel, que quelques instants plus tard, il aurait sans aucun doute expiré. Le marchand le souleva avec précaution dans ses bras et l'apporta à ses parents.

Ils étaient heureusement en quelque sorte préparés à cet événement, et s'étaient munis (n) de tout ce qui était nécessaire pour le restaurer. Bientôt il ouvrit les yeux et tous les

chagrins de cette cruelle journée furent oubliés. M. et Mme Dérambert, Augusto et Fanny étaient fous de joie; c'est à peine si dans les premiers moments ils songèrent à remercier celui qui leur avait rendu leur enfant; mais après avoir baigné de larmes le visage du petit malheureux, après l'avoir pressé mille fois contre leur cœur, ils se jetèrent au cou du marchand en le comblant de bénédictions.

Mais, Moustache! de quelles caresses ne fut-il pas l'objet! c'était à qui (o) le choierait, le flatterait, l'embrasserait. L'intelligent animal paraissait (p) prendre part au bonheur général; il courait d'Auguste à Fanny, de Fanny à Alfred dont il léchait les petites mains avec un air de contentement inexprimable. On aurait dit qu'il se rappelait le service qu'aurait rendu, les trois enfants lui avaient rendu, et qu'aujourd'hui il se trouvait heureux d'avoir pu leur témoigner sa reconnaissance, en sauvant l'un d'eux.

COLLOQUIAL EXERCISE.

- | | |
|--|--|
| 1. Comment paraissait alors le marchand? | 10. Où s'arrêta-t-il enfin? |
| 2. Où s'était-il placé? | 11. Qu'aperçut alors le marchand? |
| 3. Que dit-il tout à coup? | 12. L'enfant était-il mort? |
| 4. Quelle était la contenance du chien lorsqu'il repartit? | 13. Que fit ensuite le marchand? |
| 5. Qu'est-ce que ses gestes indiquaient? | 14. De quoi les parents s'étaient-ils munis? |
| 6. Que dit le maître? | 15. Ouvrit-il bientôt les yeux? |
| 7. Quelle fut la question de la mère? | 16. Les parents montrèrent-ils beaucoup de joie? |
| 8. Quelle réponse fit le marchand? | 17. Que firent-ils après avoir embrassé le petit garçon? |
| 9. Que faisait le chien après avoir repris sa course? | 18. Moustache fut-il oublié? |
| | 19. Que faisait-il alors? |
| | 20. Qu'aurait-on dit en voyant le chien? |

NOTES.

- | | |
|--|--|
| (a) Ne songeait, dardé not. | (i) Poussa, gave. |
| (b) From mettre. | (j) From apercevoir. |
| (c) Recueillait, listened to; from recueillir. | (k) From prendre. |
| (d) From voir. | (l) From reconnaître. |
| (e) From paraître. | (m) Mort, dead; from mourir. |
| (f) Fit, from faire; is often used instead of dit, said. | (n) Ils s'étaient munis, they had provided themselves. |
| (g) From vivre. | (o) C'était à qui, they vied with one another. |
| (h) De temps à autre, from time to time. | (p) From paraître. |

KEY TO EXERCISES IN LESSONS IN FRENCH.

EXERCISE 139 (Vol. II., page 173).

1. What do you wish us to do? 2. I wish you to pay attention to your studies. 3. Do you not fear that the rain may prevent your going out? 4. We fear very much lest the rain may prevent us from fulfilling our engagements. 5. Do you doubt his being at home now? 6. I doubt his being there, it is already ten. 7. Do you require him to set out early? 8. I am astonished that he is not yet gone. 9. Do you prefer that I return those bracelets to you? 10. I prefer that you pay me for them. 11. Does your neighbour fear lest his child may go out? 12. He fears lest he fall in the street. 13. Do you not wish that your pupils may obey you? 14. I wish them to obey me, and to obey their professors. 15. Do you not fear lest that mechanic be sick? 16. I fear his being sick, for his workshop is very unhealthy. 17. Do you not regret his being obliged to work? 18. I regret his being obliged to labour above his strength. 19. Do you not wish that he be acquainted with this news? 20. I wish him to be told of it as soon as possible. 21. Does not your father wish you to buy a warehouse? 22. He wishes me to buy a saw-mill. 23. Do you wish me to leave you? 24. I wish you to remain with me. 25. I wish you to start this morning.

EXERCISE 140 (Vol. II., page 173).

1. Voulez-vous que je parle à l'artisan? 2. Je désire que vous lui disiez de venir ici demain matin. 3. Que voulez-vous que je fasse? 4. Je désire que vous m'apportiez un livre. 5. Ne désirez-vous pas que je lise votre lettre? 6. Je désire que vous la lisiez et que vous la donniez à mes sœurs. 7. Mlle votre sœur ne craint-elle pas que la pluie ne l'empêche de sortir? 8. Elle craint que la pluie ne nous empêche de sortir. 9. Doutez-vous que M. votre père soit à la maison à présent? 10. Je doute qu'il y soit. 11. Exigez-vous que je fasse mon travail à présent? 12. Je désire que vous fassiez votre travail avant de sortir. 13. Ne regrettez-vous pas qu'il soit obligé de travailler? 14. Je ne regrette pas qu'il soit obligé de travailler. 15. N'êtes-vous pas étonné qu'il le sache? 16. Je suis étonné qu'il le sache tout. 17. Exigez-vous que je le paye aujourd'hui? 18. Je désire que vous le payiez demain. 19. Que voulez-vous que je fasse? 20. Je veux que vous le payiez immédiatement. 21. Craignez-vous que le maître ne punisse votre fils? 22. Je crains qu'il ne le punisse pas. 23. Que

voulez-vous que je dise? 24. Je veux que vous disiez la vérité. 25. M. votre père ne désire-t-il pas que vous achetiez une maison? 26. Il désire que j'achète un magasin. 27. Désirez-vous que nous vous quittions? 28. Je désire que vous partiez demain. 29. Voulez-vous que je reste avec vous? 30. Je désire que vous restiez ici. 31. Désirez-vous que je lui dise cette nouvelle? 32. Je désire que vous la lui disiez. 33. Désirez-vous que vos enfants obéissent à leur instituteur? 34. Je désire qu'ils lui obéissent.

EXERCISE 141 (Vol. II., page 173).

1. What must I say? 2. You must say what you have heard. 3. Is it not necessary that I finish that history? 4. It is not necessary for you to finish it. 5. Is it not proper for me to satisfy my creditors? 6. It is proper that you do it. 7. Is it not right that I pay you what I have borrowed from you? 8. It is right that you pay it to me. 9. Can it be that your brother has forgotten his family? 10. It cannot be that he has forgotten it. 11. Is it certain that your brother has forgotten himself to such a degree? 12. It is certain that he has forgotten himself. 13. It is very sad that he has forgotten himself so. 14. Will you remain until I have put my affairs in order? 15. I shall remain until you have settled them. 16. Will it not be necessary for me to furnish that family with provisions? 17. It will be necessary for you to furnish them, provided you have them. 18. Will it not be better that you lend him money, than to let him want for necessities? 19. It will be better that we lend him some. 20. What must we do? 21. You must carry this linen to my house. 22. Is it not time for me to retire? 23. It is time that you go to bed. 24. Must I rise? 25. You must rise.

EXERCISE 142 (Vol. II., page 174).

1. Que faut-il que notre ami fasse? 2. Il faut qu'il reste chez nous jusqu'à mon arrivée. 3. Que faut-il que notre voisin fasse? 4. Il faut qu'il mette ordre à ses affaires. 5. N'est-il pas juste que vous payiez vous créanciers? 6. Il est juste que je les paye. 7. Est-il temps que votre petit garçon aille à l'école? 8. Il est temps qu'il aille à l'école, il est dix heures. 9. Faut-il que j'écrive à votre correspondant aujourd'hui ou demain? 10. Il faut que vous lui écriviez demain matin. 11. N'est-il pas fâcheux que votre frère ait déchiré sa casquette? 12. Il est fâcheux qu'il l'ait déchirée. 13. Faut-il que Mme votre mère finisse sa lettre? 14. Il n'est pas nécessaire qu'elle la finisse. 15. Est-il certain que M. votre fils ait oublié son argent? 16. Il est certain qu'il l'a oublié. 17. Il n'est nullement certain qu'il l'ait oublié. 18. Faut-il que vous fournissiez de l'argent à cet artisan? 19. Il faut que je lui en fournisse, il n'en a pas. 20. Quel que vous fassiez, vous ne réussirez pas. 21. Quel que dise M. votre frère personne ne le croira. 22. Faut-il que je vous écrive? 23. Il faut que vous m'écriviez. 24. Désirez-vous que je sois malade? 25. Je ne désire pas que vous tombiez malade (que vous soyez malade). 26. Exigez-vous que je vous dise cela? 27. Il faut que vous me disiez tout. 28. Désirez-vous que j'aille chez vous. 29. Je désire que vous y alliez. 30. Faut-il que je me lève? 31. Il faut que vous vous leviez à l'instant. 32. Faut-il que M. votre frère se couche? 33. Il faut qu'il se couche à l'instant. 34. Il est temps qu'il se couche, il est minuit.

EXERCISE 143 (Vol. II., page 174).

1. Do you think that this cloth will last long? 2. I think that it will wear well, for it is strong. 3. Do you think that our porter will be long coming back? 4. I think that he will not tarry. 5. Do you wish us to stand (to remain standing)? 6. On the contrary, I wish you to sit down. 7. Do you believe that those students can learn five pages by heart in two hours? 8. I believe that it is impossible. 9. Do you hope that our friend may come early? 10. I hope that he will arrive soon. 11. What kind of a decanter must you have? 12. I want one which holds (may hold) a litre. 13. I have a crystal one which holds two litres. 14. Do you think that that merchant grows rich at your expense? 15. I know that he grows rich at the expense of others. 16. What parasol do you think of lending me? 17. I think of lending you the best I have. 18. Will the tanner succeed in earning a living? 19. I do not think that he will succeed. 20. Do you think that this money will suffice for your father? 21. I think that it will be sufficient for him. 22. Do you believe that those gentlemen depend upon me? 23. I know that they depend upon you. 24. Do you think that the concert will take place to-day? 25. I think that it will not take place.

EXERCISE 144 (Vol. II., page 174).

1. Croyez-vous que le concert ait eu lieu? 2. Je crois qu'il a eu lieu. 3. Croyez-vous que la robe de Mlle votre sœur dure bien? 4. Je crois qu'elle durera bien, car la soie en est très bonne. 5. Croyez-vous que notre ami réussisse à gagner sa vie? 6. Je crois qu'il y réussira, car il est très diligent. 7. Pensez-vous que le tanneur s'enrichisse à mes dépens? 8. Je pense qu'il s'enrichit aux dépens d'autrui. 9. Le marchand s'enrichit-il aux dépens de mon père? 10. Il s'enrichit à vos dépens. 11. Quelle sorte de maison vous faut-il? 12. Il me faut une maison qui ait dix chambres. 13. J'ai une bonne maison qui a douze chambres. 14. Quelle sorte de carafe cherchez-vous? 15. J'en cherche une qui contienne trois litres. 16. J'en ai une qui contient deux litres; je vous la prêterai. 17. Quel habit

m'enverrez-vous? 18. Je vous enverrai le meilleur que j'ai; prenez garde de le tacher. 19. Pensez-vous que l'étudiant apprenne tout cela par cœur? 20. Je ne crois pas qu'il l'apprenne. 21. Pensez-vous qu'il vienne? 22. Je crois qu'il viendra bientôt. 23. Pensez-vous que M. votre père compte sur moi? 24. Je sais qu'il compte sur vous. 25. Ce monsieur ne compte-t-il pas sur moi? 26. Je pense qu'il compte sur votre frère. 27. Le portier rentrera-t-il bientôt? 28. J'espère qu'il ne tardera pas long-temps. 29. Ne voulez-vous pas me prêter votre parapluie? 30. Je vous le prêterai avec plaisir. 31. Mon frère reste-t-il debout? 32. Il ne veut pas s'asseoir. 33. Désirez-vous que je m'assoie? 34. Je désire que vous restiez debout. 35. Je désire qu'il vienne.

EXERCISE 145 (Vol. II., page 202).

1. Would you wish me to buy a coat half worn out? 2. I wish that you should buy a new one. 3. Did they wish that sick soldier to repair to his post? 4. They wished that he might repair to his regiment. 5. Would it be necessary for me to dwell on the sea-shore? 6. It would be necessary, for the recovery of your health, that you should repair to Switzerland. 7. Do you not think that this child resembles his mother? 8. I do not think (that) he resembles her. 9. Whom does he resemble? 10. He resembles his eldest sister. 11. Would you consent to your daughter's marriage with that drunkard? 12. Would you have us die with want? 13. I feared lest those ladies might die with the cold. 14. Will you not fire at that hare? 15. I might fire at that woodcock, if my gun were loaded. 16. How many shots would you have me fire? 17. If you had powder, I would have you fire at that partridge. 18. Do you wish me to cast a glance upon that letter? 19. I would have you read it. 20. What would you have me do? 21. I would have you pay attention to your studies. 22. Would it be necessary for me to go out? 23. It would be necessary for you to remain at home. 24. What would you that I should do to that horse? 25. I would have you strike it with the whip.

EXERCISE 146 (Vol. II., page 202).

1. Que voudriez-vous que je fasse? 2. Je voudrais que vous jetassiez un coup d'œil sur cette lettre. 3. Voudriez-vous que je donnasse des coups de bâton à ce chien? 4. Je voudrais que vous donnassiez des coups de fouet à ce cheval. 5. Exigeriez-vous que nous revinssions à cinq heures? 6. J'exigerais que vous revinssiez de bonne heure. 7. Pensez-vous que votre frère ressemble à M. votre père? 8. Je ne pense pas qu'il ressemble à mon père. 9. À qui pensez-vous qu'il ressemble? 10. Je crois qu'il ressemble à ma mère. 11. Combien de coups (de fusil, &c.) avez-vous tirés? 12. J'ai tiré cinq coups sur cette bécasse. 13. Ne voudriez-vous pas que je tirasse sur cette perdrix? 14. Je voudrais que vous tirassiez sur cette perdrix, si votre fusil était chargé. 15. Où faudrait-il que je demeurasse? 16. Il faudrait que vous demeurassiez au bord de la mer. 17. Voudriez-vous que je mourusse de faim? 18. Je ne voudrais pas que vous mourussiez de faim. 19. Voudriez-vous que votre frère mourût de froid? 20. Je ne voudrais pas qu'il mourût de froid ou de misère. 21. Que voudriez-vous que fit M. votre fils? 22. Je voudrais qu'il apprit ses leçons. 23. Voudriez-vous qu'il apprit l'allemand? 24. Je voudrais qu'il apprit l'allemand et l'espagnol. 25. Avez-vous tiré sur ce lièvre? 26. Je n'ai pas tiré sur ce lièvre. 27. Faudrait-il que je sortisse? 28. Il faudrait que vous sortissiez. 29. Faudrait-il que je restasse ici? 30. Il faudrait que vous allassiez à l'église. 31. Que désirez-vous? 32. Je voulais que vous m'écrivissiez. 33. Voudriez-vous que j'achetasse un habit à demi-usé? 34. Je voulais que vous achetassiez un bon chapeau.

MECHANICS.—VII.

AXIS OF SYMMETRY—STABLE AND UNSTABLE EQUILIBRIUM.

AXIS OF SYMMETRY.

THERE is a large number of cases in which, though we may not be able actually to find the centre of gravity, we can say it is on some line in reference to which the body is symmetrically formed. In an egg, for example, the line joining the round and pointed ends is an axis of symmetry. If we make cross sections of it perpendicular to this line, they will be all circles through the centres of which the line will pass. The elliptical oval at a, Fig. 33,* and the cylinder at c, and the right cone at d, are instances. The cubical box at e is another, in which the cross section is a square, the line joining the meetings of the diagonals on the upper and lower faces being a symmetrical axis. The oval board at b, also, in which all the dotted lines

* It will be noticed that some of the figures which have been employed in Lesson VI. in Mechanics have been introduced a second time in the present lesson. This has been done to spare the reader the trouble and annoyance of having to turn from one page to another when reference has been made in the course of a lesson to any figure which has been used before as a means of illustrating the text. Whenever, therefore, any figure is given a second time, it must be understood that this is the reason for its repetition.

are bisected by the arrow perpendicular to them, is another instance, the arrow being the axis of symmetry. Wherever

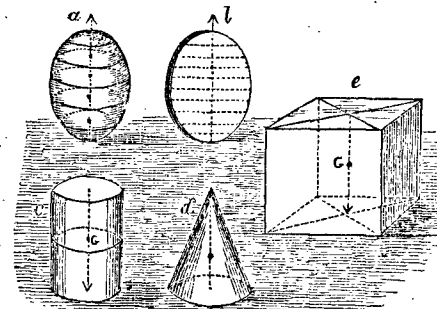


Fig. 33.

two such axes exist, of course the centre of gravity is their point of intersection; but if there be one only, as in the portion of the ring in Fig. 34, the position of the centre on it must be ascertained by other means.

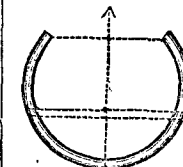


Fig. 34.

STABLE AND UNSTABLE EQUILIBRIUM.

In the last lesson, I showed you that when a body rests in equilibrium on a horizontal plane, the perpendicular from the centre of gravity falls within its base. This condition being satisfied, it will not

upset of itself, but may be overturned from without by a force acting sideways. What are the conditions on which depend the ease, or the difficulty, with which it can be so upset? Let three cylinders, a, b, c, Fig. 35, be taken in illustration; the first of broad base and small height, the other two of equal heights and bases, the latter narrow in each. Suppose that a force, say of one pound, represented by the dotted arrow pointing to the right, is applied transversely to each, and let the weights of the bodies be represented by arrows pointing downwards on the vertical lines in which their centres of gravity lie. Now, the resultant in each cylinder of these two forces, represented by the arrows slanting to the right, is the upsetting force. If this arrow strikes the ground outside the base of any cylinder, it will overturn; if within, it will remain standing as before.

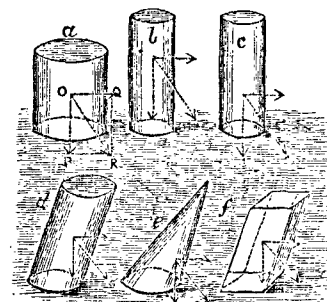


Fig. 35.

1. Now, taking any one of the cylinders, say a, it is evident that the transverse force remaining the same, and the height at which it is applied the same, the greater its weight is the longer will the arrow o r be, and therefore the more will the resultant o n slope downwards towards o p, tending to fall within the base. Therefore, everything else being the same, the greater the weight of the body the less easily is it upset, that is, the more stable it is.

2. Again, supposing the weights of the two cylinders, a, c, to be equal, but the base of the former greater than that of the latter, if equal transverse forces be applied to both at equal heights, then o n being also equal in both and equally inclined to o p, the resultant will tend more to fall within the base in a than in b, that is, everything else being the same, the broader the base the greater the stability.

3. Further, if, as in b and c, the bases and weights being the same, and the transverse force applied to each cylinder being still one pound, the force is applied higher up in one cylinder than in the other, then the resultant is more likely to meet the ground within the base in the latter than in the former; that is, the lower down the transverse force is applied, everything else being the same, the greater the stability.

4. Lastly, as is evident from *d, e, f*, in Fig. 35, when the bodies incline to one side, the perpendicular from the centre of gravity meets the base nearer to its circumference on that side; and, if the transverse force is applied in that direction, the resultant tends more to fall outside the base; that is, everything else being the same, the stability is least when the upsetting force acts in the direction in which the body leans.

These are truths known to everybody from experience, but of which here you see the "reason why," and, what is of no less advantage, you obtain a rule by which you may measure the amount of stability or instability in any case that may come before you. If you draw figures for bodies of different weights, different bases, different transverse forces, and their heights of application, you will by trial feel your way, and soon clearly understand the subject.

But the cases to which the terms "stability" and "instability" are more commonly applied, are those in which there is only one point of support, and the slightest force from without causes disturbance.

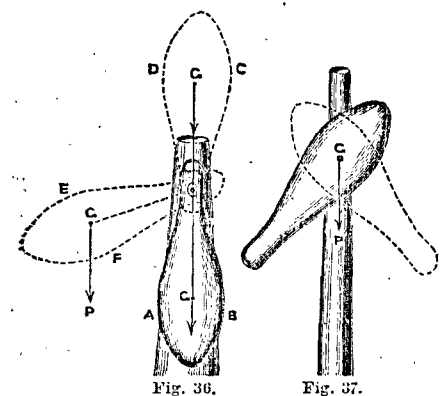


Fig. 36.

Fig. 37.

ance. In Fig. 36, as was shown in Lesson V. (page 152), the body supported at the point *o* is in equilibrium in the two positions *o a b* and *o c d*. Now, the first of these is one of stability, the second of instability. What do these terms denote? This: that if you pull the stable body out of its rest into any other position to right or left, say *o e f*, back it will return to *o a b*, as though by a free choice. In the disturbed position *o e f*, the weight acting downwards at *g* pulls it back; it can descend, but not ascend. Try the same on the position *o c d*; the body, no longer supported from below, cannot re-ascend; down it will rush to the stable position; and, after oscillating there for a few turns, come to rest. We see thus that in stable equilibrium the centre of gravity is in the lowest possible position; in unstable in the highest.

Now, take the same body attached to the post at its centre of gravity, *g*, Fig. 37. However you turn it round, *g* is supported, and the body rests. The equilibrium, therefore, is neither stable nor unstable. It neither returns on disturbance to the first position, nor rushes away from it. This is termed "neutral equilibrium;" the centre can neither ascend nor descend.

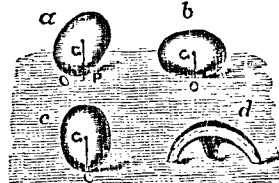


Fig. 38.

Now take the egg-shaped bodies, Fig. 38; that represented at *b* is stable, for the centre of gravity, supported from below, is in the lowest possible position. Disturb it into the position *a*, this centre ascends, and the weight pulling downwards brings it back to *b*. The body in the position *c* is unstable. It is in equilibrium, but on

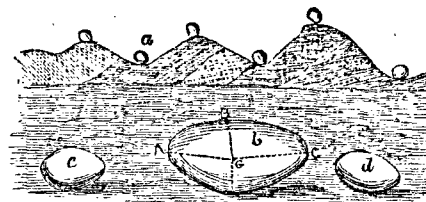


Fig. 39.

disturbance rolls through the position *c* into the position *b*. In this case also you see the centre, for stability, must be in its lowest position; for instability, in its highest. But perfectly

round balls, such as in Fig. 27 (page 200), are neutral, their centres, as you roll them on the ground, can neither ascend nor descend.

Take now the balls in *a*, Fig. 39, which represents a geological section of hills and valleys. Those on the tops of the hills are unstable, because their centres of gravity are in their highest positions. Disturb them, and down they roll into stable positions in the valleys, the lowest positions of these centres. But here now a new principle is brought to light. A body may admit of several positions of equilibrium, but an unstable is always between two stables, and a stable between two unstables. The ball in the valley has a ball perched on the hill on either side, and the ball on the hill has a ball in the valley on either side.

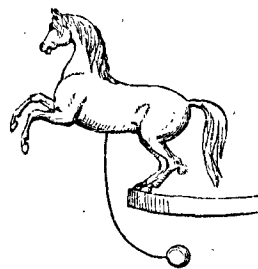


Fig. 40.

Take another illustration. Let it be a convex body, like a sea-shore pebble, with one side, as in Fig. 39, *b*, flatter than the other. I showed you in the last lesson that such a body should have as many positions of equilibrium on a plane as you can draw lines from its centre of gravity piercing its surface at right angles. Let such points in this pebble be *A, B, C, D*, the first and third more distant from the centre *G* than the other two. If I now try to make it rest on the ground at *A*, the centre being higher than it would be if the body touched the ground on either side of that point, it will roll down to either *B* or *D*, which are two stable positions. We thus learn that, The Positions of Equilibrium of a convex body, supported from below, are alternately stable and unstable.

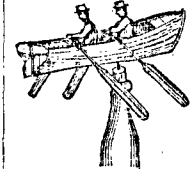


Fig. 41.

As a further illustration of the peculiarities of the centre of gravity, take an egg. Why does it generally rest with its pointed end downwards, as at *d*, Fig. 39, while an egg, as at *c*, turned in wood of the same size and form, rests broad-end down? Explain, also, the reason the prancing-horse toy, represented at Fig. 40, supported at the edge of a table, and having a wire attached to him, which carries a heavy ball at its other end, does not fall on the ground, but, when disturbed, rocks backwards and forwards. Also, how a rocking-horse is set rocking by the child on his back. The four-dared boat and crew in Fig. 41, supported by the point of a needle on the iron upright below, imitates a boat's motion at sea, rising, and plunging, and going round, if the oars are loaded at their ends; explain this. Also, how the harlequin, Fig. 42, is balanced on his pedestal, as he twirls round and bows, leaning forward and falling backward at the imminent peril of coming to the ground. Instances of this kind could be multiplied without end, but as much as our space allows has been said on the centre of gravity, which we shall now leave to apply the principles so far set forth to practice, commencing with the Mechanical Powers.

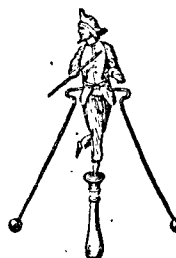


Fig. 42.

ANSWERS TO QUESTIONS IN LESSON V.

1. To prevent the perpendicular from his centre of gravity falling outside his base as he springs on the fore-foot to advance. On coming down to counterpoise the centre of gravity's falling forward.
2. He draws his feet under the chair, in order to get a base over which, by leaning forward, he brings his centre of gravity, and lifts that centre upwards by his muscular strength.
3. He leans to the opposite side in order to keep the common centre of gravity of himself and bucket over the base of support.
4. Else the perpendicular from his centre of gravity would meet the ground in advance of his feet.
5. Because the resultant of the forward motion, and the weight of horse and rider acting at their common centre of gravity, is then more apt to meet the ground outside the base of support of the horse's legs.
6. Because in that case the perpendicular from the centre of gravity, being lower down, is less apt to meet the ground outside the base when the road slopes to one side.

THE UNIVERSITIES.—III.

CAMBRIDGE.—I.

We purpose in this, and other articles which will follow, to give our readers some slight sketch of the University of Cambridge, and of its mode of proceeding to degrees, coupled with a few hints on the general course, and the method of passing through its curriculum with the least possible expense. Our remarks will form, so far as our space will allow, a brief practical guide to the student who desires to obtain from this University the degree of B.A., as well as to candidates for the local examinations for young people of both sexes, and the higher examinations for women, which this University was the first to institute.

Let us first of all distinguish between the colleges and the University. Of the former (not reckoning Cavendish or Selwyn Colleges) there are seventeen, and these together form the University, which has its own proper officers selected from the resident members of the colleges, except in the case of non-collegiate students. To be "attached," a student must first of all become a member of a college, and then, on going into residence, matriculate as a member of the University. To become a member of a college, it is necessary to produce a certificate, signed by some Cambridge M.A., to the effect that he believes the candidate to be a person qualified, "both as to learning and moral character," to be a member of the college. At some of the colleges there is also an entrance examination. This, of course, is only intended to exclude such as are not up to the standard of the lectures delivered in the college. At some colleges also the baptismal certificate is required.

It is advisable that the student should decide, either before or immediately after commencing residence, as to the course of reading which he intends to pursue. He may take his degree either in honours or in the ordinary examination. If he decide for the former, he will pass the previous examination in his first term, and there will lie open to him the mathematical, classical, moral science, natural science, and law triposes. The examination for each of these is held once in the year; and the whole of the student's reading should be specially arranged with a view to the final examination. On this part of the subject we shall make a few remarks further on. If the student decide for the ordinary degree, he will have to pass three examinations:

- i. The previous examination, or "little-go," in the first or any later term of residence.
- ii. The general examination, not earlier than the end of the second year.
- iii. The special examination, not earlier than the end of the third year.

For the ordinary or poll degree it is only necessary to reside from October in one year to the following May two years. This is the shortest possible time, inasmuch as the University requires a residence of nine terms (of which there are three in each year) before granting the degree of B.A.

On the subject of terms, it may be sufficient to say that there are three in the course of the year: the Michaelmas or October term, from October 1 to December 19; the Lent term, from January 8 to the Thursday next before Easter Day; the Easter or Midsummer term, from the Tuesday after Easter Day to June 24. To keep any term the student must reside in college or in a lodging-house licensed by the University, and must dine in hall and attend chapel during two-thirds of the above specified periods.

We have now to make a few general remarks upon the honour triposes, and the examinations for the ordinary degree. According to the new scheme, first in force in 1883, the examination for the mathematical tripos consists of three parts, lasting for three days each. Part I. commences on the Thursday before the last Sunday but one in May; it is elementary, and embraces Euclid, arithmetic, algebra, plane trigonometry, and the elementary parts of conics, statics, dynamics, hydrostatics, optics, Newton, and astronomy. On the eleventh day after the conclusion of Part I., the moderators and examiners declare what persons deserve mathematical honours, or an ordinary B.A. degree, or to be excused from the general examination for the B.A. degree; and those persons only can present themselves for examination in Part II. who are declared deserving of mathematical honours. The examination in Part II. (in higher mathematics) begins the Thursday following the last

Sunday in May. On the seventh day after the termination of Part II., a list of candidates is published, in which account is taken of the examination in Parts I. and II., and arranged in three classes—wranglers, senior optimes, and junior optimes—each class being in order of merit. The wranglers only are eligible for examination in Part III., which begins the first Monday in January, and is divided into four groups of advanced subjects. On the tenth day after the end of the examination in Part III., a division list is published, arranged alphabetically in three divisions. The moderators and examiners may place in the first division any candidate showing eminent proficiency in any one group.

A student who goes up to Cambridge with a fair knowledge of mathematics can scarcely fail to pass the second of the honours examinations by merely using the lectures of his college. But to obtain a good place it is decidedly advisable to have the assistance of a private tutor, in undergraduate language called a "coach." To any one considering the question of expense this will be a serious drawback, and more will therefore be said on the subject under the head of "tuition." Suffice it here to say that, starting with a fair knowledge of Euclid, algebra, trigonometry, and perhaps a little conic sections, a man of ordinary ability may reasonably expect to place himself, by the aid of the college lectures alone, amongst the senior optimes. At St. John's and Trinity the college lectures are said to be sufficient to place a man amongst the wranglers.

According to the new regulations, the first examination for the classical tripos commences on the Monday after the last Sunday but one in May, not sooner than the fifth term; the second is held not sooner than the eighth term, and commences on the Monday after the last Sunday in May. The examinations comprise papers in Greek and Latin, prose and verse, composition, translation from the standard Greek and Latin authors, and ancient history. To take a good place, it is absolutely necessary to have undergone a thoroughly sound classical training and grounding while at school. For the mathematical tripos a man may prepare himself by diligent "coaching" after going into residence, but this cannot be done in the case of the classical. It will be useless for any to attempt it who have not a sound groundwork of Greek and Latin knowledge before entering the University. The examination ranges over the whole field of classical literature, and its object is to test the knowledge rather than the memory of the candidate. It is with a view to this that the pieces are selected, and it frequently happens that students of very extensive reading have not previously seen more than one-half of the pieces set. In the second part the candidate may take not more than two of the following subjects—history, philosophy, philology, and archaeology.

The examination for the moral sciences tripos (which was established as recently as 1851) is held in May, and embraces moral, mental, and political philosophy, logic, metaphysics, and political economy. This tripos, in contradistinction to the classical, requires no school training, and students will therefore start more on a level with their competitors. To it is appended a pass examination in moral philosophy, history, and political economy, which also, with the three classes of the tripos, entitles to the degree of B.A. The natural sciences tripos was also instituted in 1851, and the examination embraces chemistry, physics, mineralogy, geology, botany, zoology, comparative anatomy, human anatomy, and physiology. Of course it is obvious that when so vast a field of study is included in one examination, only general principles and their application can be expected of the student. The examination, which is held in May, is made as practical as possible by requiring the candidates to analyse certain submitted specimens from the various departments.

The examination for the law tripos is held in May, and embraces Roman, English, and International Law, English History, and English Constitutional Law. This tripos entitles to the degree of B.L., or Bachelor of Laws, and it is, of course, invaluable to those whose destiny is the profession of the law, enabling them to prepare themselves while at Cambridge for their future reading, and without any unnecessary waste of time to pass from the degree of B.L. to that of M.L. and LL.D.

In addition to those already mentioned, there are also the Theological, Historical, Indian, and Semitic Languages triposes, full details of which may be found in the University calendar.

Madagascar, contains about 970 square miles, and has a population of upwards of 200,000. Mauritius, belonging to Great Britain, is about 115 miles north-east of Bourbon, contains 713 square miles, and has a population of about 370,000. Attached to it in government are the Seychelles or Mahé Islands, the Amirante Islands to the north of Madagascar, and Rodrigues, about 300 miles east of the Mauritius. The Comoro Islands are situated in the Mozambique Channel, Pemba Island and Zanzibar Island off the coast of Zanguebar, and the island of Socotra about 130 miles east of Capo Guardafui, being about 80 miles long, and having a surface of nearly 1,200 square miles.

Capes, Headlands, and Promontories.—The capes, headlands, and promontories of Africa form some of its most remarkable features. On the north is Cape Ceuta (the ancient *Abyla*), a high promontory jutting out into the sea, and terminating in perpendicular rocks; this promontory lies directly opposite the rock of Gibraltar (the ancient *Calpe*), in the Strait of Gibraltar; and these two rocky headlands, flanking the water-way from the land-encircled Mediterranean Sea into the open expanse of the Atlantic Ocean, were denominated by the ancients the Pillars of Hercules. In the Mediterranean, eastward from these, are Ras-al-Krun, Cape Blanco, and Cape Bon; and westward and southward, in the Atlantic, are Cape Spartel, Cape Cantin, Cape Nun, Cape Bojador, Cape Blanco, Cape Verd, Cape Roxo, Cape Sierra Leone, Cape Palmas, Cape Three Points, Cape Formosa, all north of the equator; south of this line are Cape Lopez, Cape Negro, Cape Frio, and Cape Voltas; while doubling the Cape of Good Hope, are to be seen False Cape, Cape Agulhas, Cape Natal, and others on the south coast of Africa. Ascending the east coast, towards the equator, occur Cape Corrientes, Cape St. Sebastian, Cape Delgado, and a variety of other capes called by the common name of *Ras*, which signifies *head* (originally from the Hebrew), just as *cap* signifies *head*, from the Latin *caput*. In the Red Sea, the entrance to which is by the strait of Bab-el-mandeb, there are a variety of capes known by the same appellation, *Ras*, but they are too minute for a general view; and of the Isthmus of Suez, common to Africa and Asia, we have formerly had occasion to speak.

The mountains of Africa, as far as the interior is concerned, are scarcely known. In the northern part of this continent are the celebrated mountains, long known by the name of Atlas, and as having originated the name Atlantic, still applied to the surrounding ocean. These mountains run through the Barbary states, and separate them from the Great Desert; they vary in elevation from 3,000 or 4,000 to 11,400 feet, the latter being among the highest points, and situated near the city of Morocco. Through Abyssinia runs another range, separated by deep valleys and gorges into ranges, groups, and sometimes isolated peaks, of which the most elevated rise to the height of 15,000 feet above the level of the sea.

In Western Africa are to be found the Kong Mountains; and in Eastern Africa, the mountains Kilimanjaro, Mfumbiro, and Kenia, each of which is from 10,000 to 20,000 feet high, and connected with vast interior mountain ranges, called by some the Mountains of the Moon, and by others the Blue Mountains, the whole forming a rampart round the outer edge of the inland basin which contains the great equatorial lakes. Within the limits of Cape Colony there are ranges of mountains rising from the coast towards the interior in a series of precipitous steep and plateaus, that form a succession of what may be termed gigantic steps. These terraces, with the mountain slopes that edge them towards the south, are three in number, namely, the Swellendam Mountains, near the coast, of which Table Mountain, 3,582 feet high, forms a part; the Swarte, or Black Mountains, further inland; and a third range in the interior, which is known by different names in different parts of the chain, being called the Nieuwveld Mountains in the west, Sneevbergen in the centre, and Drakensberg in the east. Some peaks of the Drakensberg attain a height of 10,000 feet, and form the culminating points of Southern Africa.

Table-lands, Plains, Deserts.—The table-lands, plains, and deserts in this continent are immense and to a great extent unexplored. Sahara, or the Great Desert, is a vast plateau, varying in elevation from 1,000 to 5,000 feet in height, with valleys and oases, or fertile tracts of land, intervening at distant intervals, to relieve the general monotony and sterility. Its length is about 3,000 miles, and its breadth in some places exceeds 1,000 miles; it stretches from the shores of the Atlantic

to the hills which border the valley of the Nile on the west. Eastward of that river, and stretching to the shores of the Red Sea, are the deserts of Egypt and Nubia, high plateaus traversed by ranges of mountains, in which are formed the torrent beds which create the annual inundations, and fertilise the valleys of those countries. In the south of Africa, between the parallels 22° and 27° S. lat., is the Kalahari Desert, a vast elevated plateau 3,500 feet above the level of the sea, from which the ground slopes on either side towards the sea.

Lakes.—In Central Africa lies the great basin of Lake Tchad, several thousand square miles in surface, varying with the seasons, and receiving some small tributary streams. This lake is surrounded by the kingdoms—if kingdoms they may be called—of Kanem, Bornou, Baghirmi or Begharmi, and Waday. It is the centre of a rich, fertile, and prosperous country. To the east of Lake Tchad is Lake Fittre; and near Timbuctoo, on the west, is a small sheet of water through which the main stream of the Niger runs, called Lake Debo or Dibble. In Dahomey are the small lakes Avon and Denham. In the southern part of the continent are Lake Ngami, Lake Dilolo, Lake Nyassa, Lake Shirwa, and Lake Shuia—all discovered or explored by Livingstone. On the equator, and to the south of it on the eastern side, are Lakes Victoria Nyanza, Albert Nyanza, and Tanganyika, the first discovered by Captain Speke, Tanganyika by Captains Speke and Burton, and Albert Nyanza by Sir Samuel Baker. In Abyssinia is Lake Dembea.

Rivers.—The principal river in Africa is the celebrated Nile; it consists at first of two great arms called the Bahr-el-Azrek, or Blue Nile, fed by head-streams that rise in Abyssinia, and the Bahr-el-Abiad, or White Nile, which derives its waters from Central Africa. It was thought when the Victoria Nyanza was discovered by Speke that the great reservoir that supplied the Nile had been discovered. It was, however, found by Sir Samuel Baker, a few months after, that the Nile issued from Lake Albert Nyanza, the Victoria Nyanza emptying itself into this sheet of water by a short broad stream, called the Somerset. The true origin of this river has occupied the attention of many of the world's most noted travellers and explorers during the present century, and foremost in the list of those who have devoted their lives and energies to the great work must be placed the name of David Livingstone, who, after years of unprecedented toil and sacrifice, died in 1873, just when his labour seemed about to be crowned with success. The course of the Nile may be estimated at from 2,500 to 3,000 miles in length. The chief rivers of Eastern and Southern Africa, following the coast from Cape Guardafui, are the Juba, Pangany, Zambesi, Limpopo, Elephant River, Great Orange River, Coanza, Congo, and Gaboon. On the west coast of Africa are the following rivers of considerable note, and no small value in this part of the continent:—The Senegal of 1,000 miles, and the Gambia of the same length, both watering the district Senegambia, whose appellation is formed by their united names; and the Quorra, Joliba, or Niger, about 2,300 miles in length, rising in Nigritia or Soudan, and falling into the Bight of Benin.

With this lesson we give our readers a map of Egypt, a country to which the attention of the public has of late years been frequently directed—as, for instance, on the occasion of the opening of the Suez Canal—and in whose fortunes Great Britain is closely interested.

SUMMARY OF BOUNDARIES.
North: The Mediterranean.
South: South Atlantic Ocean and Indian Ocean.

East: Red Sea, Indian Ocean.
West: The Atlantic Ocean.

SUMMARY OF OCEANS, SEAS, GULFS, ETC.

Atlantic, W. and S. of Africa.
Indian Ocean, E. of Africa.
Red Sea, E. of Africa.
Mediterranean Sea, N. of Africa.
Gulf of Sidra, Mediterranean.
Gulf of Gabes, Mediterranean.
Gulf of Guinea, S. of Guinea.
Bight of Benin, Gulf of Guinea.
Bight of Biafra, Gulf of Guinea.
St. Helena Bay, Cape Colony.
Saldanha Bay, Cape Colony.

Table Bay, Cape Town.
False Bay, Cape of Good Hope.
Algoa Bay, Cape Colony.
Delagoa Bay, N. of Natal.
Sofala Bay, Sofala.
Mozambique Channel, E. of Sofala.
Gulf of Aden, S.E. of Red Sea.

SUMMARY OF STRAITS.
Gibraltar, Mediterranean.
Bab-el-Mandeb, Red Sea.

SUMMARY OF ISTHMUSES.
Suez, between Mediterranean Sea and Red Sea, connecting Asia and Africa, and crossed by railway and the great Suez Canal.

SUMMARY OF ISLANDS.
The Azores, W. of Portugal.
Madeira, W. of Morocco.

multiplier under the corresponding terms of the multiplicand. Multiply each term of the multiplicand by each term of the multiplier separately, beginning with the lowest denomination in the multiplicand and the highest in the multiplier, and placing the first figure of each line one place to the right of that of the preceding line, under its corresponding denomination. Finally, add the several lines together, carrying 1 for each 12 both in multiplying and adding. The sum will be the answer required.

EXAMPLE.—(2.) Find the area of a board 9 ft. 7' 2" long, and 3 ft. 4' 7" wide.

$$\begin{array}{r} 9 \text{ ft. } 7' 2'' \\ 3 \text{ ft. } 4' 7'' \\ \hline 28 \text{ sq. ft. } 9' 6'' \\ 3 \text{ sq. ft. } 2' 4'' 8'' \\ \hline 32 \text{ sq. ft. } 5' 5'' 10'' \end{array} \quad \text{Answer.}$$

We now subjoin some other examples connected with square and cubic measure, such as are of frequent occurrence, not confining ourselves to the method of duodecimals.

EXAMPLE.—(3.) Find the cost of carpeting a room 24 ft. 6 in. long by 18 ft. 4 in. wide, with carpet which is $\frac{3}{4}$ of a yard broad, and costs 3s. 9d. a yard.

$24\frac{1}{2} \times 18\frac{1}{2}$ = number of square feet in the floor,
and the breadth of the carpet is $\frac{3}{4}$ of a foot.

Therefore the length of carpet in feet $\times \frac{3}{4}$ ft. = area of floor in sq. feet = $24\frac{1}{2} \times 18\frac{1}{2}$.

Therefore the number of feet of carpet required = $\frac{24\frac{1}{2} \times 18\frac{1}{2}}{\frac{3}{4}}$.

And each foot of carpet costs 1s. 3d., or $1\frac{1}{4}$ s.

Therefore, required cost = $\frac{24\frac{1}{2} \times 18\frac{1}{2}}{\frac{3}{4}} \times \frac{5}{4}$ shillings
= $\frac{49 \times 55 \times 4 \times 5}{2 \times 3 \times 9 \times 4} = \frac{13475}{54}$ shillings = £12 9s. 6d.

EXAMPLE.—(4.) What is the height of a room which contains 223 cub. yds. 7 cub. ft. 624 cub. in. of air, the area of the floor being 41 sq. yds. 12 sq. in.?

Since the cubical contents are obtained by multiplying the three dimensions of length, breadth, and height together, and the area of the floor is obtained by multiplying the length and breadth together, we shall evidently get the height of the room by dividing the cubical contents by the area of the floor.

223 cub. yds. 7 cub. ft. 624 cub. in. = 6028 $\frac{1}{2}$ cub. ft. = 6028 $\frac{1}{2}$ cub. ft.
41 sq. yds. 12 sq. in. = 369 $\frac{1}{4}$ sq. ft. = 369 $\frac{1}{4}$ sq. ft.

Hence required height in feet = $\frac{6028\frac{1}{2}}{369\frac{1}{4}} = \frac{217021}{36} \times \frac{13}{4429} = \frac{217021}{3} \div 4429$
 $\frac{217021}{3} \div 4429 = 17716$

39861
39861
.....

Hence required height = $\frac{1}{4}$ feet = 16 feet 4 inches.

EXERCISE 63.—EXAMPLES IN SCALES OF NOTATION, DUODECIMALS, CROSS MULTIPLICATION, ETC.

1. Transform 12345678 from the decimal to the duodecimal scale, and vice versa to the scale of 7.
2. Transform 58367 from the decimal to the duodecimal scale.
3. Transform 57439 from the duodecimal to the decimal scale.
4. Transform 67535 from the scale of 8 to the scale of 6.
5. Transform 79658 from the duodecimal scale to the scale of 8.
6. Transform 4444 from the duodecimal to the decimal scale.
7. How many square feet are there in a board 15 ft. 7 in. long, and 18 in. wide?
8. How many cubic feet are there in a block 18 ft. 5 in. long, 4 ft. 1 in. wide, and 3 ft. 6 in. thick?
9. Find the area of a space 18 ft. 3' 4" by 6 ft. 5' 8" 10".
10. Find the area of a space 18 ft. 0' 5" 10" by 4 ft. 8' 7" 9".
11. What will it cost to plaster a room 20 ft. 6 in. long, 18 ft. wide, and 10 ft. high, at 6d. a square yard?
12. How many bricks 8 in. long, 4 in. wide, and 2 in. thick, will make a wall 6 ft. long, 10 ft. high, and 2 ft. 6 in. thick?
13. Find the cost of carpeting the following rooms:—
(a) 13 ft. 4 in. long, 13 ft. 6 in. broad, with carpet $\frac{3}{4}$ of a yard wide, at 2s. 9d. a yard.
(b) 11 ft. 6 in. long, 10 ft. 4 in. broad, at 10s. 6d. a square yard.
(c) 16 ft. 11 in. long, 13 ft. 3 in. wide, with carpet 2 ft. 3 in. wide, at 4s. 7d. a yard.
14. A Turkey carpet 11 ft. 6 in. long by 9 ft. 8 in. wide is laid down on a room 14 ft. long by 12 ft. 6 in. wide; find the amount of oil-cloth

necessary to complete the covering of the floor, and its cost at 5s. per square yard.

15. The length of a room is twice its breadth, and its area is 1153 square feet; what is its length?

16. Find the cost of carpeting a room 17 ft. 6 in. long by 13 ft. 9 in. wide, with carpet $\frac{3}{4}$ yard wide, at 4s. 8d. a yard.

17. If a cubic foot of water weighs 1000 ounces, what must be the depth of a rectangular tank, which is 35 ft. long and 10 ft. broad, that it may just contain 1000 tons of water?

18. A roller being 6 ft. 6 in. in circumference and 2 ft. 3 in. wide, makes 12 revolutions as it moves from one end of a grass-plot to the other, and passes 10 times from one end to the other; find the area of the grass-plot.

19. What length must be cut off a plank $1\frac{1}{2}$ ft. broad and 9 in. deep, in order that it may contain $11\frac{1}{2}$ cubic feet?

20. A block of wood in the form of a rectangular parallelepiped measures along its edges 18 $\frac{1}{2}$ ft., 5 $\frac{1}{2}$ ft., and 3 ft. respectively; find its value if a cubical block of the same wood, whose edges are all 11 in. long, is worth 3s. 6d.

21. On laying down a bowling-green with sods 2 ft. 6 in. long by 9 in. wide, it is found that it requires 75 sods to form one strip the whole length of the green, and that a man can lay down one strip and a quarter each day; find the area laid down in 8 days.

22. If a cubic foot of water weighs 1000 oz., find to what depth a ton of water will cover an acre.

23. A square foot of paper weighed 104.68 grains, and when 320 figures had been written on it, weighed 105.155 grains. If a strip of this paper $\frac{5}{8}$ inches wide be taken to have written on it the circulating period of $\frac{1}{1000000}$ (which contains 100102 figures) in two lines at the rate of 5 figures in an inch, find the weight of the whole, and the length of the paper, and express this act in terms of the height of Salisbury spire, which is 400 feet.

Errata.—In page 142 of this vol., col. 2, line 40, for "2 $\frac{1}{2}$ " read " $\frac{1}{2}$," line 41, for "1:1:1," read "1:1:1," and in line 42, for "7 lbs. of the third," read "5 lbs."

SKETCHING FROM NATURE.—IV.

THEORY OF SKETCHING.

The previous lessons upon Sketching from Nature have been almost entirely devoted to the practice; we must now say something upon the theory, and offer our pupils some advice upon the course they must pursue amongst the difficulties they will find in the principles and application of the art. During their progress they will meet with many perplexities, for which technical rules can afford but little assistance, because the theory of art depends upon laws of quite a different nature. The rules we have given will help them over grammatical difficulties and assist them in the work of construction, and for these reasons they cannot be dispensed with; but they are incapable of giving those charms to a picture which it is the province of theory to impart, founded upon a right feeling for the beauties and effects of nature. Our pupils have now at their command a sufficient supply of geometrical information, as well as directions where to find it in these pages, and of which we hope and trust they will make good use; it will prove to be the best and most solid foundation whereupon to build other principles to be derived from a close observation of nature, and from a careful study of the numerous works of our most eminent artists. The few remarks we made in our first lesson upon the choice of a subject were offered with a view of cautioning our pupils not to overburden themselves with too many details at first, but to make their early essays from the most simple subjects they could find. It is remarkable, but very little experience will make it evident, that many subjects which at first sight appear to be easy, from the fact that they are composed of few prominent objects, will upon close examination, and especially during the process of drawing, seem to expand into a quantity of detail beyond all previous anticipation. Very frequently a feeling of discouragement is the consequence. We make this last observation, knowing from experience that in the majority of cases the cause of the discouragement did not arise from the unexpected amount of details, but because too little value was placed upon them. The results were failures; indeed, how could they be otherwise? As the pupil progresses his confidence will increase, and he will thus decide for himself the kind of subject, and its extent, that he may feel capable of undertaking. Whilst allowing this, a few words of advice may be useful. There are various reasons why, in our individual estimation, one

* A parallelepiped is a six-sided rectangular figure whose opposite sides are of equal dimensions.

subject appears preferable to another. It may be the composition of the subject, or perhaps the display of colour it exhibits; or it may be owing to the effect of light and shade. Each of these circumstances is sufficiently important to create a preference.

When we sit down to draw an out-door scene, the first questions that occur to us are: Does it compose well? Are the principal lines of the subject harmoniously arranged and connected with each other? Do any of the less important parts obtrude in such a way as to offend the eye with their masses and angles, to the detriment of other parts of greater consequence? These questions, and others of a like nature, will suggest themselves; and in the course of our experience we shall find out that we have the liberty, or licence, as it is termed, to modify the composition in such a way as to make it agreeable, without sacrificing the truthfulness of the whole. To apply these remarks, let us suppose we are about to draw a scene of which the view is limited; in other words, there is very little choice of position from which to take it. For instance, it might be a

the subject—rather the contrary. It is admitted to be correct in principle and in practice to make the sky subservient to the rest of the picture, as it is capable of every variety of change in form, light and shade, and in colour, and yet it need not be false to nature. Besides, a sky can be made exceedingly serviceable in giving effect, by increasing the mass of dark in a picture where it is required, or as a background to throw up objects that are in light. For instance, after a shower, when the sun has broken out, and its rays are lighting up buildings and objects in the distance, the retiring dark mass of clouds, as they dip below the horizon, give, by contrast, additional brilliancy to the effect of the sunlight.

Fig. 6 is an example of the right-angular form, of which a line in the direction from A to B (taking the lines of the hills and the trees) forms the hypothenuse; the ground, the base, and the upright trees on the right, form the perpendicular. In a subject like this the above arrangement assists the perspective, and many artists do not hesitate in the least to make such alterations in the disposition of the parts, that they may be able to

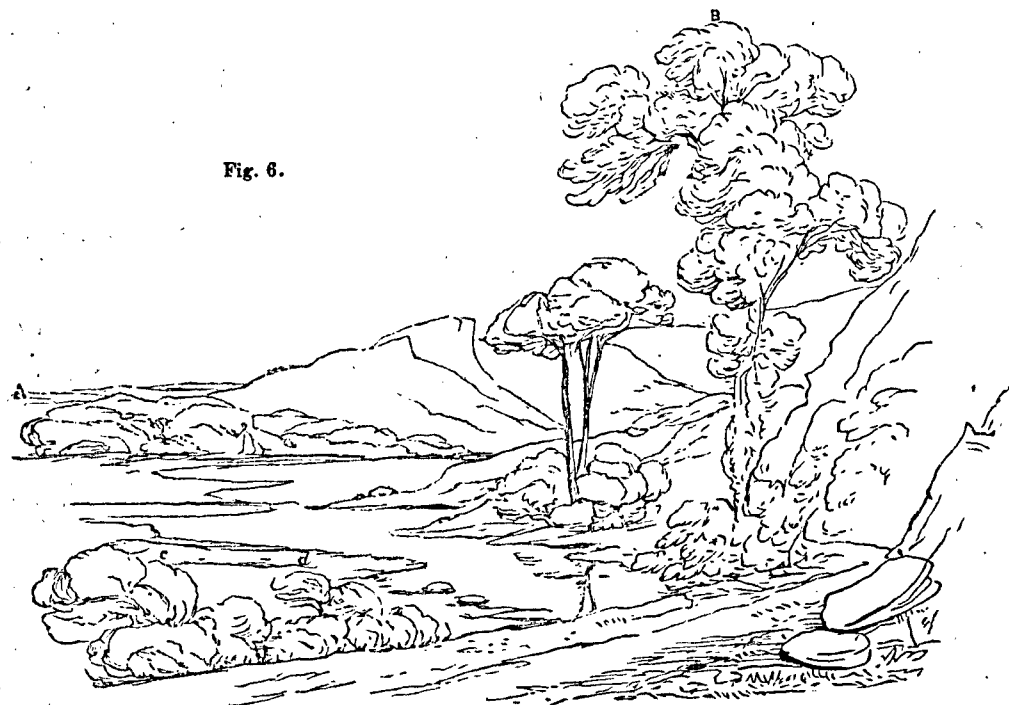


Fig. 6.

tower or ruin, having its most interesting part concealed by trees. The licence we speak of would permit that the position of the trees might be changed, or their branches directed another way; or they might be thinned or cut out so as to admit a view of the part we wish to preserve. Much of this may be done without in the least altering the character of the subject. We give this simply to supply an instance where the taste and judgment of the artist must be exercised.

One of the most pleasing forms of arrangement in the composition of a subject is that of a right-angled triangle. Whether we employ this form to include the whole subject, as in Fig. 6, or in parts or in groups, as in Fig. 7, certain it is that it affords an opportunity for great contrasts, with an harmonious blending of intermediate forms and proportions to combine them. With regard to preserving the triangular form of composition, if desirable, much may be done by slight alterations to make the picture more effective. The growth of a particular tree may be improved, and another, much in the way, may be carried back in the picture. Sometimes the massing of clouds in certain parts will assist; and we may observe here that clouds and skies in general are great resources when difficulties arise in the composition of a landscape, because many liberties may be taken with their arrangement which cannot in the least interfere with

preserve this character. If a couple of poplars stood in the foreground, at c or d, of the same height as the tree on the right, and on the same plane, they would either leave them out, or put them further back with different heights; or, with the help of the sky as a background, modify their prominence, so as not to destroy the general character of the composition. Some will even venture to remove trees and buildings to other situations altogether. It was the frequent practice of an eminent English landscape painter to take great liberties with his subjects in this respect. He would remove a large group of trees to the opposite side of a river, rather than they should interfere with the lines he wished to preserve; and especially if they were useful in their new position to give additional improvement to his picture. But a wholesale interference with the true portraiture of the landscape is dangerous without long previous experience; in youthful hands it may act prejudicially in the practical part of the work. It is only they who know well what they are about who can venture to such an extent as we have just mentioned. At first, let our pupils bear in mind that they must proceed step by step; copy Nature closely until they can copy her well; then afterwards they may be able and at liberty to adapt or alter as they find necessary, or as their improved taste and judgment may dictate. Mr. John Burnet shows what a master-mind is

capable of, in a passage to be found in his work upon landscape painting in oil. It is thus:—"In examining the pictures of Claude Lorraine, and especially the work of the 'Libor Veritatis,' containing prints from these pictures, we are struck with the various ways in which his studies from nature were applied and dovetailed in, as it were, to the composition of a complete work. The connecting links which his own taste made necessary for this purpose, give us a clear insight into the mode of generalising his ideas. The strong passages from nature are interwoven and toned down in their harshness by the extension of the forms in more delicate lines, and their abruptness swallowed up by bringing the softening influence of shadow to come in contact with them."

In our choice and treatment of a subject, we must bear in mind that there should be always one leading object to form the central attraction of the composition, and we must devote sufficient care and attention to its character and details, that the eye may have something to rest upon at once, before it is allowed to wander off to other parts. It is a practice, or rather a habit of which few are aware, but all follow without any predetermination, first to look for something upon which the eye may repose; and, however interesting the details may be, the principal object will certainly be the last the eye rests upon before it leaves the picture. This being the case, the theory of composition teaches us to provide for this result. Very frequently a few figures will give an interest to the subject, and afford an opportunity for concentrating the attention of the spectator upon the picture.

A view which an inexperienced eye would pass by without any especial remark, may be made exceedingly interesting. Let us go out and sketch a view on a common; there may be nothing much in it; it may be very dull and flat; but something, we trust, will turn up as we proceed to make it more lively. The one we have chosen has no trees upon it, except one, old and dead, possessing only a few angular and leafless branches. Its trunk, almost totally stripped of the bark, has still clinging to it a piece of ivy; and even that is weak and straggling. On the left of the tree, and at about the centre of the picture, is an unused gravel pit, in which we perceive the leavings and rubbish of a recent gipsy camp. These are the principal features, and we might have passed it by, but as we have sat down to draw it we will try to make a picture out of it. We begin by marking in the general lines of the gravel pit, place the position of the tree on the right of the picture, and indicate its trunk and branches. We also arrange some of the lines of the furze, and brambles, and other wild shrubs, whose forms, wave-like, rise and fall, gradually blending both in form and colour into the distance, until the eye is arrested by a low line of far-off hills. This is the arrangement. Now we must trust to details in the drawing to make up the rest, re-commencing with the gravel pit, the top of which makes an incline from the tree, and dips into a hollow partly out of sight. The left slope of the pit is covered with brambles and honeysuckles, and we now perceive for the first time a stream of water, running under the shelter of some dock-leaves and foxgloves. Whilst we are drawing these a donkey approaches, and stations itself upon the bare spot under the old tree, and its foal lies down by its side. These are valu-

able additions to our picture. Two ragged children, wondering what we are about, come out of curiosity to watch our proceedings. Soon finding no amusement in this, they go into the gravel pit, and turn over the rubbish the gipsies have left. These afford other suggestions, and are added to our picture. Some ducks, from off the common, come and dabble in the little stream amongst the dock-leaves. We take advantage of these also. We then devote our attention to the mid-distance, amongst patches of purple heath and yellow furze; and here we avail ourselves of the pictorial licence already mentioned by removing a cottage, partly surrounded by apple-trees, which is placed beyond the limits of our picture. We see only its white gable, pierced with one small window, and its thatch and chimney; but this is enough, and we place it peeping above the furze in the mid-distance. This object helps to break a long monotonous line, and adds another idea to the whole. Beyond this some peat-gatherers have lit a fire, and its curling smoke amongst the dark heather affords another kind of contrast. The whole surface of the scene is broken up by passing lights and cloud-shadows, which, as they float along, bring out alternately brilliant bits of colour, backed up by shades of various tones to relieve them.

Thus a sameness is avoided, and what is very important, they assist the perspective. The sky also helps us; its patches of blue, broken up by a few dark clouds, with their thousands of semi-tones and white masses, form an excellent background, against which we put in the sharp and carefully drawn tendrils and leaves of the ivy on the old tree. We finish with the weeds and wild flowers in the foreground, brighten up the children's dresses, put a few more brilliant touches to the ducks, the sparkling water, and the most prominent of the leaves and branches of the brambles, tone down the shadows on and near the donkeys, and 'having finished our sketch, we exclaim,

"All this comes of a dead tree and a gravel pit!"

A repetition of extreme contrasts must be avoided. They would render the picture, if in outline, angular and harsh; if in colour, or light and shade, the result would be "patchy." Such effects are startling, but they are not pleasing when repeated. They must be accompanied by middle tones of various grades. Black and white in juxtaposition are not agreeable; but place combinations of them in conjunction with the extremes, and a very different effect is produced. The same may be said of colours without their combinations; lines also. Suppose a perpendicular line cuts an horizontal one (and where there is a repetition of these the effect becomes worse), it will be necessary to take off the harsh effect they produce by adding inclined lines (see Fig. 7, where the stooping and inclined figures unite the two extremes, the one on the ground and the upright figure).

We must now say something about the introduction of figures and other objects, all of which contribute largely to the interest of a picture. If we draw a view of a river and its surroundings, and there is a towing-path at the side, there ought to be boats and barge-horses. A farm-yard is not complete without cattle and pigs; or a sea-coast without its boats and fishermen. In short, whatever may be the character of the landscape, the character of the figures must be in unison. To qualify, there-

Fig. 7.



EXERCISE 64.—GREEK-ENGLISH.

1. Life brings many painful things with it. 2. Know thyself. 3. Wish to please all, not thyself alone. 4. The wise man carries about his property in himself. 5. Utter the praise of thy friends rather than thine own. 6. Virtue is honourable in itself. 7. The greedy enrich themselves, but injure others. 8. The incontinent are not only injurious to others without being profitable to themselves, but are doers of evil to others, but most so to themselves. 9. We gratify ourselves most. 10. The gods are free from envy, even amongst one another. 11. Bad men injure one another.

EXERCISE 65.—ENGLISH-GREEK.

1. Οί σοφοί περιφέρουσι τα πράγματα εν έαυτοίς. 2. Ο πλεονεκτής έαυτον τ λουτίζει άλλους δε βλαπτει. 3. Ύμνος χαρίζεσθε. 4. Ο ακρατικός ουκ εστι τοις μεν άλλοις βλαβερός, έαυτῳ δε ωφελίμος, άλλα ακουήτος μεν των άλλων, έαυτῷ δε πολυ ακουήτοτερος. 5. Αγαθαί παιδεί, άλλήλους στερήγете.

EXERCISE 66.—GREEK-ENGLISH.

1. My father is good. 2. All men love their own fathers. 3. Your children learn their letters earnestly. 4. Your children are beautiful. 5. Your children are excellent. 6. Our children blame our condition. 7. Your friend is faithful. 8. My friend is faithless. 9. Your intellect governs your body. 10. My boy is diligent, but yours is remiss.

EXERCISE 67.—ENGLISH-GREEK.

1. Σος πατηρ εστιν αγαθος. 2. Ο πατηρ μου εστιν αγαθος. 3. Ημῶν ὁ πατηρ ευτιν αγαθος. 4. Σφετεροι δουλοι ειναι κακοι. 5. Ημετεροι μεν παιδες σπουδαιως μανθανουσι, υμετεροι δε εισι μεθημονες. 6. Ο φίλος σου έαυτον μεν τα εργα θαυμαζει, ου δε τα των άλλων.

THE HISTORY OF ART.

XVI.—THE ENGLISH SCHOOL.

ART, in its westward progress, at last reached the shores of England. During the mediæval period, we in Britain had already possessed a large school of native architects and decorators, who raised for us the great piles of Lincoln, Salisbury, and Lichfield, of Windsor, Warwick, and Durham, of Oxford, Cambridge, and Glastonbury. But our domestic artists had never turned largely in the direction of painting and sculpture in their highest forms. At best, they had been satisfied with shrines and decorative frescoes; they seldom attempted anything in the way of high art, as practised even then in Italy and Flanders. Moreover, from the Reformation onward, one great stimulus of painting and sculpture was gone from England. The old creed had encouraged art by encouraging pictures and statues of saints and martyrs: the devotional spirit of the people had been turned into a more or less distinctly æsthetic channel. The new creed swept away almost all church decorations at once, and the Puritan reaction, which carried further the work of the first reformers, made many people look upon art in any form as little short of sinful. Thus for some time in England there was hardly any native artistic movement of any sort; and when an artistic movement at last arose, it owed its origin rather to the wealthy few than to the popular masses. In Italy and the Low Countries, painting sprang from the many, and ministered to the wants and sentiments of the many; in England it was at first a special product to meet the tastes of the few, and to those tastes—often artificially acquired abroad—it entirely devoted itself. Hence English art was originally a costly exotic, tended with care by wealthy hands, and it only slowly acclimatised itself to our peculiar circumstances. It began by being a foreign import, a luxury for the noble mansions, and gradually made its home among us, coming down at last in our own day to the level of all.

As early as the days of Henry VII., Italian artists found occupation at the English court. Under his son, Henry VIII., the famous German portrait-painter, Hans Holbein, came to London by invitation of Sir Thomas More, and his pencil has preserved for us many of the bearded statesmen and court beauties of that stormy period. In Elizabeth's reign, a general Italianising tendency became marked in England; and the great nobles began to build themselves large palaces in the Italian style, with gardens and terraces, of which Knowle, Audley End, and Somerset House are examples. A row of such houses lined the whole length of the Strand, from the City to Westminster. These mansions were decorated within with painting, and presented a great contrast in their open galleries and broad staircases to the dark rooms and narrow

winding turret steps of the old-fashioned feudal castles. Charles I. was a great patron of foreign art; he invited over Rubens, who painted several of his finest pictures here, and Vandyck, who spent the best part of his life in producing portraits of the king and his cavaliers. During the Puritan triumph of the Commonwealth, the nascent feeling for art, as yet unnaturalised in the native English mind, died down again in great part; and it only revived with the Restoration. Sir Peter Lely, a Dutch painter, born in Westphalia, but taught at Haarlem, came to England in the reign of Charles I., and became so thoroughly an Englishman by adoption that he may almost be considered as the first great English artist. He painted a portrait of Cromwell, and managed to exist through the Commonwealth; but with the return of Charles II. he rose at once into the greatest eminence. He has kept alive for us the fair faces and lissome figures of the beautiful women who crowded the licentious court of the Restoration. His style is extremely refined, but very much marked by the prevailing loose tastes of his times. The hands in his portraits are especially famous for their grace and delicacy. Lely's feeling is quite unlike that of the Dutch school, and is very English in many of its characteristics. He caught exactly the tone of the aristocratic world in which he mixed, and produced such paintings as would please its refined and somewhat over-delicate taste. In this he struck the key-note of the early English school of painters, who lived as the clients of lordly patrons. Sir Godfrey Kneller, a native of Lübeck, and pupil of Rembrandt, took up the succession after Lely. He was painter by appointment to all our sovereigns from Charles II. to George I., and his portraits represent for us the round-faced, periwigged, close-shaven nobles of that comfortable time with some technical ability, but with very little power or feeling. His attitudes are wooden, and his faces lack expression or character.

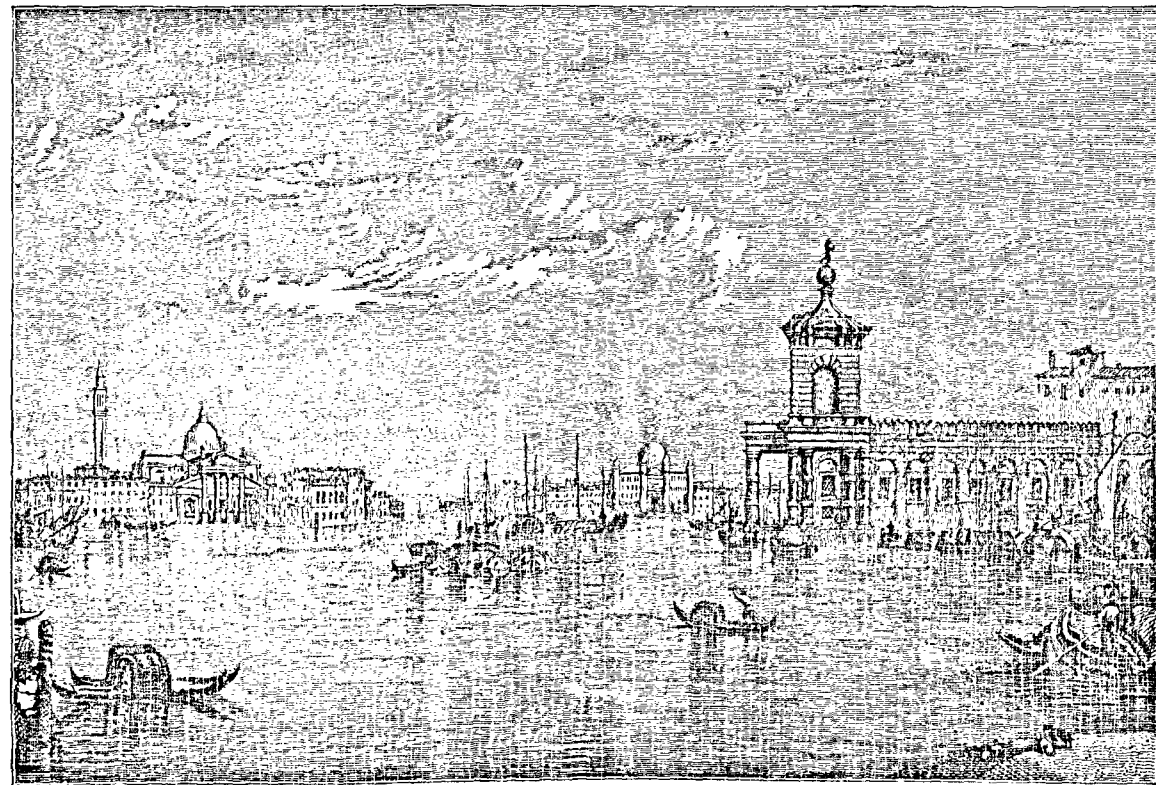
The first really English-born artist of any eminence, and the true founder of the English school of painting, was William Hogarth. This singular genius was born in London, in 1697, and studied under Sir James Thornhill, the decorator of the dome of St. Paul's, Blenheim Palace, Greenwich Hospital, and several other public buildings. After trying his hand, without much success, at portraits and historical painting, he at last struck out that peculiar style of satirical and domestic art which has made his name so famous. His principal works are the three celebrated series of the "Rake's Progress," the "Harlot's Progress," and "Marriage à la Mode," each consisting of several pictures, arranged so as to tell a consecutive story. Hogarth's painting is English in the extreme—more characteristically English, indeed, than that of almost any among his successors; for he exhibited in the highest degree many of our original national faults, which have been carefully toned down and partially eliminated by subsequent taste and study. He is coarse in sentiment and too powerful in satire, but he invented a totally new department of art, and made his pictures detail a plot as no one before him had ever succeeded in doing. They might almost be described as novels on canvas. He loved to take the common objects of low life around him—a gin-shop, a street musician, a drunken soldier, an election scene, a group of strolling actresses—and to reproduce them in vivid caricature, with great humour and unsparing fidelity to the truth at its very worst. Though at first but ill received, he slowly fought his way up against prejudice and incredulity, amassed a considerable fortune, and died painter by appointment to the king. Altogether, it was Hogarth who first revealed the popular side of modern English art. He left alone the portraits of kings and duchesses, or the adventures of heathen gods and mediæval saints, to paint the subjects that he saw and knew—the world around him, with all its loves and hates, its virtues and its foibles, its mean vices and its genuine pathos. It must be acknowledged, however, that the satirical and humorous view of life was uppermost in Hogarth's mind, and that his pictures often shock us as much by their brutality and coarseness as they please us by their power and force.

Very different in tone and feeling was our great national portrait-painter, Sir Joshua Reynolds, the second founder of the English school. Reynolds was born at Plympton, in Devonshire, 1723, and studied under Hudson, then the leading portrait-painter of his day, in London. He visited Italy, and there made a personal acquaintance with the works of Raphael

and Michel Angelo, which he carefully studied; and on his return he soon rose to eminence in his own art. His social position—he was the son of a Devonshire rector—gave him an easy introduction to society; and when the Royal Academy of Painting was founded, in 1768, Reynolds was made its first president, and received the honour of knighthood. The foundation of the Academy in itself marked the growing importance of art in England. Sir Joshua devoted himself almost entirely to portrait-painting, and was particularly happy in his treatment of children. There is something peculiarly idyllic and touching in his handling of such themes. His "Strawberry Girl," his "Infant Samuel," and many others of his childish pictures are universal favourites. They have an unspeakable purity and gracefulness of their own. He knew how to represent the innocence and roguishness of

beautiful. The "Blue Boy" and the famous "Duchess of Devonshire" are among his best-known works. As a landscape-painter, Gainsborough struck the key-note of the English school in his love for typical and purely English scenery, as well as in the simplicity and quiet delicacy of his treatment. His works are redolent of the truly English feeling of home and country peacefulness. He had also an extraordinary knack of hitting off striking effects with a few casual touches of his hasty brush.

We can find room for only one later name, that of Joseph Turner, the most distinguished amongst all our great masters of landscape-painting. Turner was born in London about 1769, and lived till 1851, so that his life links together a past and a present generation to a remarkable extent. The son of a hair-dresser in Covent Garden, he picked up his love for nature among



VENICE. (By Turner.)

childhood with exquisite tenderness and fidelity, and his delineation of female beauty in "Kitty Fisher" and other portraits is unsurpassed for grace and truthfulness. Sir Joshua died in 1792. His name still perhaps remains the very greatest in all the annals of English art.

Not unlike Reynolds in style and sentiment was George Romney, born at Dalton, in Lancashire, in 1734. He also devoted himself largely to portraits, though he likewise produced many historical and fanciful pieces. His delicacy and softness are scarcely inferior to Reynolds', and his tone is perhaps even more poetical and graceful. The dancing group of the children of the first Marquis of Stafford gives a very good idea of his half-classical, half-English fancy.

More strictly contemporary with Reynolds was Thomas Gainsborough, who was born in Suffolk in 1727. Gainsborough was one of our earliest great landscape-painters, and he also largely devoted himself to portraits, which indeed have always had a tendency in England, till very lately, to monopolise too much the time and attention of our greatest artists. His portraits of children are almost as famous as Sir Joshua's for their airy lightness, and his women are often surprisingly

the cabbages and carts of the great market. He began painting in water-colours, and though he afterwards produced most of his greatest works in oils, yet he always retained his love for his earliest medium. Turner's landscapes are quite unique in their peculiar wealth of colour, their extraordinary glow, their bold effects of light and shade, and their keen sympathy with natural beauty. He had an ardent imagination which led him to idealise whatever he saw, while at the same time his idealisation was always wonderfully subordinated to the truthful delineation of external nature. He copied exactly what he saw, yet he managed in doing so to transmute it with his own brilliant fervour so as to make it something very different from what it appeared to the common or untutored eye. His sea pieces are especially grand and striking. In his later years a defect of vision seems to have somewhat blurred his fine eye for nature, and some of his last pieces are extremely hazy with yellow light, and very lacking in distinctness of form. Their originality often reaches the length of positive eccentricity. Many of his finest works he left as the property of the nation.

Since the end of the last century, English art has blossomed out so fully that it would be impossible to follow it further in

detail. Our school has widened in numbers and in styles till we now reckon probably more great living painters than any other country in Europe, France alone excepted. Our national faults and excellences in art are those which spring from our national character; and while we are doing our best to preserve and increase the latter, it is hoped that by watchfulness and intercourse with the wider world of art we are gradually overcoming the former as well.

LESSONS IN ITALIAN.—VII.

V.—PRONUNCIATION OF THE LETTERS C, G, S, IN COMBINATION WITH OTHER LETTERS (continued).

7. Gna, Gne, Gni, Gno, Gnu.

Gn is a combination almost as important as gl. G before n must never be omitted to be sounded, as in the English words *gnaw*, *gnat*, etc.; but Englishmen are apt to forget this, and to sound the combination gn in several foreign languages as if no g was before the n. The combination gn must, likewise, never be sounded as gn in the English words *signify*, *malignity*, *assignment*, *physiognomy*, *cognisance*, and so on. Those who know French will be able to sound gn at once by bearing in mind the correct pronunciation of gn in the French words *mignon*, *mignard*, *peigner*, *oignon*, etc., with which the Italian pronunciation of gn exactly agrees. Those who do not understand French may form a notion of the sound by the same operation pointed out in my explanation of the sound of gl. They must, as it were, sound the n before the g, and change the latter into y; only taking care that the voice should glide rapidly from n to y, and squeeze, as it were, these two letters into one very mild enunciation. Indeed, this very mild enunciation of the squeezed sound gn is a peculiarity of the Italian language, and among foreigners, Germans, who have no corresponding sound, rarely arrive at a correct pronunciation of the gn. The English have words, the pronunciation of which may be said to be an approximation to the Italian sound; as, for example, *bagnio*, *seignior*, *poignant*, *champignon*, *Spaniard*, and, perhaps, most of all, in the word *cognac*; and therefore Englishmen may, without much difficulty, arrive at a correct pronunciation, never losing sight of the peculiar squeezed and mild sound of the Italian gn.

I shall try to imitate the sound gn by the letters *ny* in a similar way to that in which I have imitated the sound gl before i and another vowel by the letters *ly*; and where in Italian words the gn occurs in the middle and at the end, the first n must go in some respect to one syllable, and the second n along with the y to the next; the voice rapidly gliding from one of those syllables to the other in the way I have already stated. For example, *campagna* (pronounced kahm-piñ-nyah), country; *vegnente* (ven-nyen-tai), future, next; *Giugno* (joón-nyo), June; *gnocchi* (nyók-kee), small dumplings, clowns; *scrigno* (skrin-nyo), bunch, a coffer; *Spagnuolo* (Spahn-nyooó-lo), a Spaniard. I must not omit the remark that foreigners, in Italian pronunciation, are apt to confound the two combinations gn and ng as though they were the same. This is not the case. In uttering gn, the g must be converted into y and sounded after n; while in uttering ng, the g retains the natural sound depending on the vowel that follows. In uttering gn, the n, which is heard before the g, has its natural sound; while in uttering ng, n has a kind of nasal sound. Further, the combination gn always retains its peculiar sound irrespective of the vowels that may follow, which is illustrated in the pronouncing table below; while in the combination ng, g has the sound of the English g in *get* before the vowels a, o, and u, and the sound of the English j before the vowels e and i. For example: *Giugno* (joón-nyo), June, and *giungo* (joón-go), I arrive, I join; *angelo* (áhn-nyo-lo), angel, and *angelo* (áhn-jai-lo), angel; *pugno* (poón-nyo), fist, cuff, I fight, and *pungo* (poón-go), I sting. As a last remark on the gn, I have to note that when gn is followed by the letter i, it is a sign that *gni* is to form a syllable by itself; and the i in such cases is never a mere auxiliary letter—never a mere soundless written sign to indicate that gn is to have a squeezed sound, because, as I have stated, gn has naturally, and without any exception, a squeezed sound. This is quite different in the combination gl, and makes the essential difference between the combinations gl and gn. The reader will not have forgotten my remarks in the preceding lesson, that when gl is followed by the vowels a, e, o,

and u, and the letter i is interposed between these vowels and the gl, i is a mere auxiliary letter, and denotes the squeezed sound of gl, somewhat similar to that of gl in the English word *seraglio*. For example, *compagnia* (pronounced kom-pahn-nyé-ah), company, certainly differing from the word *compagna* already stated.

Italian.	Pronounced.	English.
Gnao	nyáh-o	Mewing of cats.
Gneo	nyé-o	Gnejus.
Gnido	nyés-do	Gnidus, a town of Caria.
Gnome	nyó-mai	A gnome.
Gnuno	nyó-no	Nobody, not one.
Bagno	báhn-nyo	Bathing-place.
Segno	sén-nyo	Sign.
Cigno	tchín-nyo	Swan, cygnet.
Sogno	són-nyo	Dream.
Pugno	póon-nyo	Fist, cuff, I fight.
Cognato	kón-nyáh-to	Brother-in-law.
Pignora	pín-nyai-rai	To push.
Cognito	kón-nyee-to	Known.
Signore	sín-nyó-rai	Sir.
Ognuno	on-nyó-no	Everybody.

8. Sca, See, Sci, Sco, Scu.

Italian.	Pronounced.	English.
Scabro	skáh-bro	Rough.
Pesca	pai-skah	Fishing, fishery.
Pesca	pé-skah	Peach.
Scemo	shái-mo	Diminution, diminished, I diminish.
Bisce	bée-shai	Snakes.
Scipa	shé-pah	An ignorant man.
Fasci	fáh-shee	Bundles, fuses.
Scoglio	skól-lyo	Shell, rock, danger.
Bosco	bó-sko	Forest, wood.
Scocio	skóo-tcho	I undo something sewn, I rip.
Scuro	skóo-ro	Obscure.

9. Sch, Scia, Scie, Scio, Sciu, Scr, Sg, Sgh, Sq.

Italian.	Pronounced.	English.
Schiatta	skeeáh-tah	Issue, progeny, generation, race.
Schietto	skeeét-to	Pure, unmixed, candid, sincere, ingenuous.
Fisch	fé-skee	Whistles.
Schioppo	skeeóp-po	Gun.
Schiama	skeeóo-mah	Froth, scum.
Sciame	sháh-mai	Swarm of bees.
Scienza	shén-tsah	Science.
Sciocco	shók-ko	Stupid, a fool.
Sciupa	shóo-pah	He wastes, spoils.
Scranna	skráhn-nah	Camp-stool, folding-chair.
Screzio	skré-tseoo	Discord, quarrel.
Scrigno	skrin-nyo	Bunch, coffer.
Scrofa	skró-fah	A sow.
Scruto	skró-to	I scrutinise.
Sgarro	zgárr-ro	Error.
Sgherro	zghérr-ro	A hector, bully.
Sghigno	zghín-nyo	I sneer.
Sgorbio	zgúrr-beoo	Spot of ink.
Sgusto	zgóo-sto	I get tired of.
Sguscio	zgóo-sho	I shell.
Squadra	skwáh-drah	A square (instrument), squadron.

I have repeatedly in these lessons marked the combinations *qua*, *gue*, *gui*, *quo*, and the combinations *qua*, *que*, *qui*, *quo*, with "gwah . . ." and "qwah . . ." I must, however, warn the reader not to give to the w in these cases the full and legitimate sound of the English w, which is peculiar to the English language. I might have marked these combinations "gwah . . ." and "qwah . . ." and so they are marked by the distinguished grammarians, Abate Flario Casarotti, and other writers on Italian grammar; but the Italian v is a softer sound than the English v—a kind of medium sound between the w and the English v. On this account I have thought it more advisable to mark these combinations with v instead of w, and if the reader will avoid the peculiarity of the pronunciation of the English w (pronounced with a forward motion and instant withdrawal of the lips), pronouncing it more like a softer v, he will approach the true sound.

Squillo	skwíl-lo	Sound, gimlet.
Squaja	skwó-yah	He flays.
Pasquale	pah-skwáh-lai	Paschal.
Risquoto	rec-skwó-to	I exact, I redeem, I shudder.
Inclito	in-klee-to	Renowned.

Ciclone	te'ee-klo-pai	Cyclops.
Recluta	rai-kloó-tah	Recruiting.
Inglese	in-glái-zai	Englishman.
Anglicano	ah'n-gee-kahno	Anglican.
Ecloga	é-glo-gah	Eclogue.
Ingluvia	in-glóo-veai	Voracity.
Tecla	té-klah	Thecla (a woman's name).
Cicli	tché-lee	Skies.
Sicli	sée-klo	Shekel (a Hebrew coin and [weight]).
Egla	é-glah	Egla, a name.
Angli	áhn-gee	Englishmen.
Anglo	áhn-glo	Englishman.
Glutine	glóo-tee-nai	Glue, birdlime.

10. Glia, Glie, Glio, Gli.

Italian.	Pronounced.	English.
Tovaglia	to-váhl-lyah	Table-cloth, towel.
Oneglia	o-nél-lyah	Oneglia, a town in Sardinia.
Famiglia	fah-míl-lyah	Family.
Invaglia	in-vól-lyah	Wrapper.
Aguglia	ah-góol-lyah	Needle.
Paglia	páhl-lyai	Straws.
Veglie	vál-lyai	Vigils, evening parties.
Figlie	fil-lyai	Daughters.
Moglie	mól-lyai	Wife.
Guglie	góol-lyai	Obelisks.
Vaglio	váhl-lyo	Sieve, I sift.
Voglio	vél-lyo	An old man.
Giglio	jíl-lyo	Lily.
Loglio	lól-lyo	Cockle-weed.
Luglio	loól-lyo	July.
Ragli	ráhl-lyee	Rays.
Vegli	vél-lyee	Old men.
Tigli	tíl-lyee	Linden-trees.
Sogli	sól-lyee	Thrones.
Fugli	foól-lyee	Was to him.

In the previous pronouncing table, the reader will have remarked that two vowels, when i is the first, may come together in one syllable without constituting a diphthong. The reason of this is, that in such cases the i is not heard, or scarcely perceptibly touched in more measured enunciation, and only serves the purposes of an auxiliary letter, to denote to the eye that the preceding consonants c, g, or gl, in such combinations as *cio*, *cui*, etc., *gia*, *gio*, *giu*, etc., *glia*, *glie*, *gliu*, etc., are to have what may be termed the squeezed sound. The letter i is not heard, or scarcely heard, and why should it form a diphthong simply because in juxtaposition with another vowel? The same observation is applicable to such combinations as *scia*, *scio*, *sciu*, etc., pronounced shah, sho, shoo, etc. In all these cases a diphthong is seen, but not heard, or scarcely heard. And even three vowels in combination, when i is the first, may meet in one syllable without constituting triphthongs; because in such cases as well, i is preceded by the letters c, g, and gl, not being pronounced, and only serving to denote the squeezed sound of these consonants. For example: *libricciuolo* (pronounced lee-brit-tchoó-lo), a small book; *muricciuolo* (moo-rit-tchoó-lo), a small wall; *uomicciuolo* (ooó-mit-tchoó-lo), a little man; *giuoco* (joóo-ko), a game; *figliuolo* (fil-yooó-lo), a child, son; *cavigliuolo* (kah-vil-yooó-lo), a little peg or pin. In these examples, the three vowel combinations, or, more correctly speaking, associations, are diphthongs, and not triphthongs; and it is only by confusion of signs written for the eye, with literal representations of sound, that grammarians have been led to class them as triphthongs. In taking this view, I venture to differ from many authorities; but I think I have shown reason for so doing.

I have now explained the elements of Italian pronunciation. Exceptions, philosophical reasons, delicacies, and refinements, I shall on future occasions explain in "additional remarks" on pronunciation; and any necessary further remarks that may be considered elementary, I shall likewise add from time to time.

The remark that these explanations only contain the elementary principles of Italian pronunciation, will serve to show the student really desirous of acquiring a knowledge, and not a smattering, of Italian, the importance and necessity of following me closely and carefully throughout. The pace may be tiresome, but, if taken now, will spare much labour for the future. The ingenious reader cannot fail to have noted that the tables I have given are not expanded examples of words, but systematic exercises, illustrating in natural order all vocal combinations, and thus giving an insight, from the very first, into the structure of the language.

It may be here seasonably remarked, that many persons in England learn Italian for musical purposes only. The system of pronunciation here given will be of peculiar advantage to them; for in singing Italian airs, and in reading the scores of Italian operas, nothing is so puzzling as the necessity of giving to one note what to the eye seems two, and sometimes even three syllables; and nothing is so hideous as to hear Mozart's or Rossini's music distorted by a failure to vibrate double consonants, by the neglect of the two e's and the two o's, by hard enunciation of the gn and gl, by improper syllabic distribution of vowels and diphthongs, etc.

Two more tables will finish my lessons on pronunciation, and satisfactorily initiate the student into the difficulties of this part of the language. In the concluding table I shall give a general mirror of the pronunciation, to which the student who may have a doubt as to the proper pronunciation of a word may always refer, and thus obviate the necessity of constantly imitating the pronunciation of words by signs throughout the grammar.

I have already explained the importance of mastering the difficulty to foreigners of giving the proper vibrated sound to double consonants.

LESSONS IN GEOLOGY.—VII.

EARTHQUAKES AND ALTERATIONS IN LEVEL.

THE next phase of igneous action which we shall consider divides itself into two divisions.

(1) *Earthquakes proper*, that is, when the land is shaken by a series of upheavals and corresponding subsidences; and (2) *the gradual change of level* which the land undergoes, whereby those rocks which are formed on the bed of the ocean by aqueous action are elevated so as to become dry land, and again, those parts already above the ocean level are depressed, so that, in process of time, another layer of stratified rock is deposited on the submerged surface.

These two classes of action are most closely allied. In all probability, an earthquake is one of the results of the great igneous action which produces a change of level; that is to say, when the fluctuations of the temperature of the earth's crust cause the rocks to expand or contract, a corresponding alteration of level takes place in the surface immediately above the locality, which experiences a change in its temperature. When this process is rapid—which seems to be the exception and not the rule—and if, by any means, water finds access to the heated region below, a large generation of steam is the result, and a sudden shock is imparted by the explosion to the rocks in the neighbourhood. This is propagated on all sides from the centre of disturbance in a wave, which reaches the surface, and as it rolls wider and wider from its centre, causes all the phenomena exhibited in an earthquake, gradually decreasing in its power until it becomes imperceptible.

Mr. Robert Mallet, C.E., of Dublin, very satisfactorily accounted for the earthquake motion on this supposition, following out the theory on mechanical grounds. The earthquake in South Italy in 1857 afforded him an opportunity of testing the truth of his conclusions, and he found observation fully supported his anticipations. A reference to the diagram (Fig. 11) will enable the reader to comprehend the process of earthquake disturbances.

P is the surface of the earth. c is the point, it may be many miles beneath, where the explosion which caused the disturbance occurred. The shock would be transmitted upon all sides of c in a spherical wave. The lines do not represent a succession of waves which can only take place when there are a succession of shocks, but the same wave in various positions. E c is the seismic-vertical. The effect of the earthquake in the immediate neighbourhood of E will be a vertical rising and falling, as if the ground had received a blow just beneath the surface. By the records of many earthquakes this motion appears to have been constantly experienced. The mode in which the wave passes along the surface is shown at F (Fig. 12), where it appears as a ripple running along the ground. The effect which this wave has on the objects built on the surface will be evident by considering the behaviour of the pillar at R while the wave is passing beneath it. In the diagram the pillar is thrown out of its perpendicular by the advance of the fore-slope of the wave. If it cannot bear this disturbance, it

falls exactly along the path of the wave. If it be not thrown down as the wave passes underneath it, it assumes its perpendicular position as it stands on its crest. Then it slopes the other way as it stands on its rear flank; and when the disturbance has quite passed, and the surface has subsided to its original level, the pillar, left by the wave, suddenly totters back to its perpendicular with a kind of jerk. This motion has a more destructive effect than that which first threw the shaft from its position; and if the capital did not fall off in the first instance, most probably it will be thrown off by the return of the pillar to its upright posture. In any case the line drawn from the fallen object to the base of that which supported it must be in the direction of the wave. By passing through the visited district, Mr. Mallet was enabled to map very many of these lines, and on their production he found that they all intersected within half a mile. Thus he determined the position of the point *x* (Fig. 13), directly under which was the centre of the disturbance.

To find the exact depth at which the explosion took place, observations of fissured walls were taken. It will readily appear, on inspecting the diagram, that if the wave moved in the direction of the line *c s*, the wall of the house, being bent by the emerging wave, would be fractured at right angles to its path. Therefore, a line perpendicular to the fracture would indicate the angle of emergence.

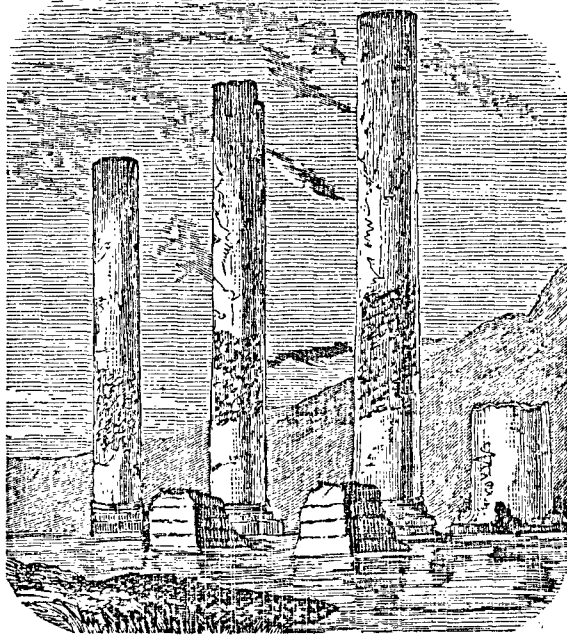
This being found, the depth of the point *c* is at once given. In the instance of this Neapolitan earthquake, the centre of the disturbance was not more than seven or eight miles beneath the surface. The above statement is but a very crude outline of the subject, as so many disturbing causes interfere with the direct results. For instance, the origin of the shock may not be a point, but the disturbance may be distributed over an area. This has received confirmation by the loud rumbling subterranean noises, which sound as if a number of violent explosions had succeeded each other in vast cavities far in the bowels of the earth. These frequently precede the shocks, the sound-waves being able to travel faster than the

earthquake-waves. Then, again, these latter waves have different velocities in various rocks, and therefore the coseismic lines—that is, the lines which mark the emergence of the wave—are not always circular, but may extend much further in one direction than in another. Hence it happens that areas disturbed by an earthquake shock are frequently of very irregular shape. Varied and peculiar phenomena are recorded as preceding and accompanying earthquakes, such as irregularities in the seasons, deluges of rain, the unusual haziness of the air, sudden calms, etc.; but as these are not general, they must be considered as accidental circumstances. It would be much beyond the limits of our space to attempt to chronicle even the remarkable earthquakes which have brought sudden destruction on thousands of human beings. There is little or no variation in the accounts, save as to the amount of damage produced by the shock. We allude to the *Earthquake at Lisbon*, which happened on the 1st of November, 1755, as an example of all earthquakes. The shock was preceded by no premonitory symptoms, but with a tremendous roar the city reeled and fell.

It seems—from observations made on the principle above referred to—that the centre of disturbance was some eighty miles out at sea. The actual scene of the gaseous explosion must have been deep-seated, for the effects of the shock were felt over an area four times as large as Europe. The water rose suddenly twenty feet in the West Indies. The great Canadian lakes felt the movement. In Scotland, Loch Lomond rose on one beach more than two feet, the water not participating in the lurch which the land gave. To the very north of Europe the waves of disturbance extended.

In six minutes 60,000 people in Lisbon perished. Many had collected on the wide expanse of the new marble quay, out of

the way of the falling houses, when suddenly the quay, with its living crowd, sank, with many ships in the harbour, and not a body, nor the splinter of a wreck, ever rose up from the watery depth. We can only suppose that a fissure opened beneath the harbour, and after engulfing the whole, as suddenly closed.



COLUMNS OF THE TEMPLE OF SERAPIS.

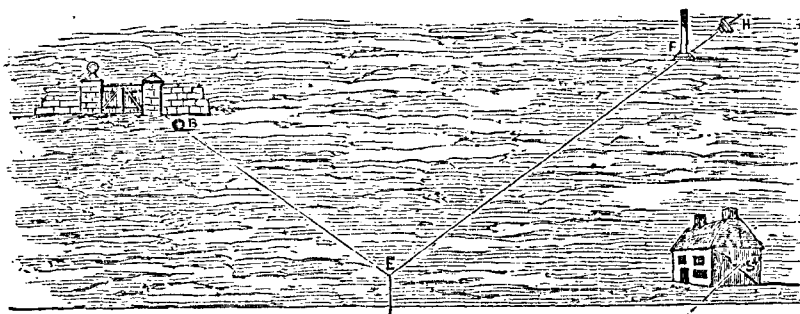


Fig. 13.

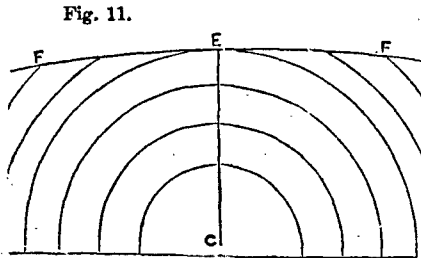


Fig. 11.

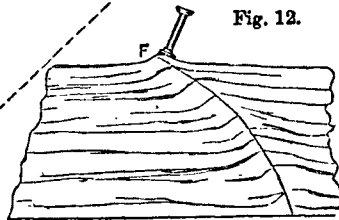


Fig. 12.

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In this earthquake a remarkable proof was offered of the fact above alluded to, that the wave is more readily propagated in some strata than in others. The destructive effect was confined to those houses which were built on the Tertiary strata. The lower part of the city, which rests on blue clay, was most severely shattered; whereas that part of the city which was built on the limestone or basalt escaped. The undulatory movement passed along the earth's surface at the rate of twenty miles an hour. The sea-wave rolled about four miles in that time. This wave is generally the cause of as much loss of life as the actual violence of the shock. This may well be supposed from the fact that at Cadiz the wave was sixty feet high. This wave is largest when the point of disturbance is under the sea; then the sea-bound towns are subject to a double inundation. The undulatory movement, when it reaches the shore, causes a great commotion, as, when a basin of water is moved, the water does not at once participate in the motion, and therefore washes up the sides of the vessel. This disturbance no sooner subsides than the sea-wave, which has followed the "ground" wave at a slower pace, rushes in upon the shore, its waters black with the sediment of the ocean-bed.

South America has for centuries been the scene of repeated earthquakes. A few years after Lima was first built, in 1582, the city was ruined, and since then the catastrophe has been repeated some twenty times. In all the cities of that neighbourhood the ecclesiastical year is full of anniversaries commemorating terrible overthrows or marvellous escapes. But none of these calamities seem comparable to that which paralysed the country a few years ago. Two shocks, on the 13th and 16th of August, 1868, passed over Peru and Ecuador, ruining every town and city, and leaving between two and three hundred thousand dead to putrify in the tropical sun. Arica, a seaport town, was completely covered by the wave. The writer of these pages hears from one who survived that, upon the first shock, at 5.15 in the afternoon, he, with some others, jumped upon a barge, when the great wave carried them on its crest completely over the town above the spire of the church, and left them unharmed nearly a mile inland.

The chief geological effect of earthquakes is shown in the permanent alteration of the level of the land. In 1822 the coast of Chili was raised some two feet, while further inland the elevation was more than double this quantity. In 1855 the coast of New Zealand for ninety miles evidenced a rise of nine feet. (For many other facts illustrative of the alteration of level—a result of an earthquake—in all parts of the world, chap. xxviii. of Vol. II. of Lyell's "Principles" may be consulted.)

But that gradual alteration of level which is not accompanied by convulsive movements is more important than these local variations. It is difficult to establish these facts, because we have no standard which is not itself subject to alteration. Careful investigation of the coast of Sweden has shown that most of the Scandinavian peninsula is rising at the rate of four feet a century. The coast is favourable for the observation. There are no tides in the Baltic, and the cliffs descend perpendicularly into the sea; the water-level has been repeatedly marked, and the rise judged by its change. In few other places are the same advantages. Mr. Darwin has suggested an ingenious proof of the sinking of the ocean-bed in the Pacific. It is known that the coral insect cannot live below twenty fathoms, the pressure of the water beyond that depth being too great for its existence. How, then, can the fact be accounted for that many of the coral structures have their foundations resting on the ocean-bed at profound depths? There is only one reasonable solution of the difficulty, that they build upon a sinking foundation, and this very fact impels their labour and increases the domains they conquer from the sea.

We have reserved one well-known proof of this repeated oscillation of the earth's crust, that of the *Temple of Serapis*, near Paazuoli, in the Bay of Naples.

The ruins of this temple consist of three pillars of marble hewn out of solid blocks. They are rather more than forty feet high.

The history of this remarkable temple seems to be this:—From certain inscriptions discovered in the neighbourhood we learn that, in 105 B.C., a temple dedicated to Serapis existed on the sea-shore. In 1823 the handsome mosaic pavement of this temple was discovered five feet beneath that from which the pillars rise. The existence of this pavement indicates

that the land must have sunk, and the present floor have been raised above the level of the water. In the early part of the third century, the Emperor Alexander Severus beautified the temple, of which these are the pillars.

At what time the temple was deserted we cannot conjecture; but in 1749 the following facts were brought to light by excavating:—That when the sea broke in, the salt-water caused a hot-spring which existed to throw down a dark calcareous deposit, two feet thick; above this a layer of volcanic tufa reposed, which must have been ejected from a neighbouring volcano; this deposit is not regular, varying from five to nine feet in thickness. The eruption seems to have formed a barrier which kept out the waters of the sea, so that the hot-spring continued to deposit its carbonate of lime, but without any marine admixture; thus about two feet more were added to the matter which embedded the bottom of the columns. More volcanic tufa was now placed upon the lime deposits, either by a storm or another eruption, making a total deposit of eleven feet. All this time the land had been sinking. The sea now surrounded the pillars, which finally sank nine feet more; thus half their height was above the water, and of that which was beneath the surface eleven feet was embedded and nine exposed to the water; in this space the pillars were perforated by a bivalve, *Lithodomus*, which is indicated in the figure by the dotted parts. Thus, if we include the lower pavement, the land must have sunk twenty-five feet from the commencement of the Christian era. When the upheaval began we cannot say, but we know it was in progress in 1530, and in 1838 the pavement was again above the sea-level. The downward movement has again commenced at the rate of about one inch annually.

Here, then, we have an evidence of a structure which has undergone an upheaval and subsidence of at least twenty feet, and still stands to attest the quietness and regularity of the movement.

From the cases cited, seeing the difficulty of proof on account of the peculiar circumstances of position requisite for such proof, we may consider that this motion of the earth's crust is far more general than we suppose, and may fairly be required to account for the successive upheaval and depression necessary for bringing the aqueous rocks to form the surface of continents.

READINGS IN FRENCH.—IX.

F E D O R A .

SECTION I.

C'ÉTAIT en mil huit cent douze;¹ Napoléon, à la tête de ses troupes victorieuses dans les plaines de la Moskowa, était entré dans l'antique capitale de l'empire des czars, et de là menaçait la nouvelle ville fondée par Pierre-le-Grand.² Poussé par un patriotisme fanatique,³ le gouverneur de Moscou, Rostopchin, prit alors cette résolution qui a porté un coup si funeste au succès de nos armes, celle d'incendier⁴ la ville, dont l'empereur Alexandre lui avait confié la garde. Nous ne raconterons pas toutes les circonstances de cet épouvantable drame. Chassés de leurs demeures⁵ en feu, croulant sous les efforts des flammes, c'était un spectacle affreux que de voir tous les habitants mêlés à nos soldats, forcés de fuir en emportant ce qu'ils pouvaient dérober à la violence de l'incendie.⁶

La petite fille d'un négociant, à peine âgée de six ans, se trouva perdue dans le tumulte.⁷ Abandonnée, transie de froid, elle errait çà et là⁸ à travers les rues que le feu épargnait encore. Son père et sa mère avaient disparu,⁹ et personne ne semblait vouloir la recueillir. La nuit se passa ainsi toute entière; et quand le jour commença à poindre, Fedora, exténuée de fatigue et de faim, s'affaissa devant la porte d'une église¹⁰ et se prit (b) à dormir.

Sans doute elle ne se serait plus réveillée,¹¹ la mort serait venue la surprendre, si une vivandière, qui par hasard vint (c) établir son petit marché de vivres¹² près de cette église, ne l'eut aperçue et ne se fut sentie touchée de compassion¹³ pour la malheureuse enfant. Elle aussi avait des enfants!¹⁴ C'est pourquoi elle s'empressa de prodiguer ses soins à la petite orpheline.¹⁵ Fedora ne savait comment lui témoigner sa reconnaissance.¹⁶ Elle devint bientôt pour sa seconde mère une aide fort intelligente. Peu à peu elle apprit à comprendre sa bienfaitrice¹⁷ et put (d) exprimer tout ce qu'elle avait renfermé de reconnaissance.¹⁸

Cependant l'armée de Napoléon commença sa retraite,¹⁸ et la vivandière dut (f) quitter Moscou. Les parents de Fœdora existaient-ils encore? C'est ce que rien n'était venu révéler.¹⁹ Fœdora partit donc avec l'armée française.²⁰ Qu'on juge de ce qu'un enfant de cet âge eut à endurer pendant une pareille retraite! Au passage de la Bérézina, Fœdora eut encore le malheur de se trouver séparée de sa bienfaitrice,²¹ soit (g) que celle-ci eut péri dans les flots, soit qu'elle crût (h) la jeune enfant égarée! Quoiqu'il en soit, l'orpheline ne la trouva plus,²² et elle se vit de nouveau délaissée.

COLLOQUIAL EXERCISE.

1. En quelle année Napoléon entra-t-il dans Moscou?
2. Quelle ville l'Empereur menaça-t-il de là?
3. Par quel Rostopchin fut-il poussé?
4. Quelle résolution prit alors le gouverneur?
5. Où étaient les habitants?
6. Que s'efforçaient-ils d'emporter?
7. Qu'arriva-t-il à la petite fille d'un négociant?
8. Que faisait la petite?
9. Où étaient son père et sa mère?
10. Dans quelle situation se trouva-t-elle à la pointe du jour?
11. Se serait-elle réveillée?
12. Quo vint faire la vivandière près de l'église?
13. La vivandière eut-elle pitié de la petite malheureuse?
14. Pourquoi eut-elle pitié de Fœdora?
15. Que fit la vivandière?
16. Fœdora parut-elle reconnaissante?
17. Qu'apprit-elle peu à peu?
18. Que fit l'armée quelque temps après?
19. Avait-on découvert les parents de Fœdora?
20. Que fit-elle alors?
21. Qu'arriva-t-il au passage de la Bérézina?
22. L'orpheline retrouva-t-elle sa bienfaitrice?

NOTES.

- (a) Ça et là, here and there.
 (b) Se prit à dormir, fell asleep; from prendre.
 (c) From venir.
 (d) From apprendre.
 (e) From pouvoir.
 (f) Dut, was compelled to; from devoir.
 (g) Soit, be it; from être.
 (h) From croire.

SECTION II.

Cependant Fœdora parvint (a) jusqu'en Pologne avec un détachement de troupes; plusieurs de ses compagnons de voyage avaient succombé, moissonnés par le froid ou par la faim, et les autres se dispersèrent tout à coup, de sorte (b) que la petite Moscovite se trouva seule, abandonnée au milieu d'une forêt.³ Mourante de froid, ayant de la neige jusqu'aux genoux, elle vit soudain un ours se diriger vers elle; alors elle recueillit (c) ce qui lui restait de forces (d) et voulut s'enfuir.⁵ Mais, hélas! comment une enfant si faible, et dont tous les membres sont presque engourdis, pourra-t-elle échapper à ce danger? Déjà l'ours est sur le point de l'atteindre, Fœdora pousse un cri, appelant au secours. Par une faveur inspérée de la providence,⁶ au moment où la bête féroce se précipite sur elle, un coup de feu (f) part, et l'ours tombe. Bientôt un étranger arrive à la place où Fœdora s'était arrêtée, à peine revenue de son effroi.⁷ Il regarde avec bonté et d'un œil de compassion cette enfant⁸ dont le ciel venait de lui confier le salut.

C'était un gentilhomme polonais appelé Polowski;⁹ il tira de sa gibecière de la viande froide, du pain, du vin, et en offrit à Fœdora,¹⁰ ce qui la ranima bientôt. Puis il prit l'enfant par la main et l'emmena dans son château,¹¹ éloigné d'environ deux lieues.

Là, Fœdora accueillie (g) avec bienveillance par la femme du noble Polonais,¹² ne tarda pas à se rétablir de toutes ses souffrances. Elle put alors leur raconter tout ce qu'elle savait de son histoire.¹⁴ Émus jusqu'aux larmes par le récit de l'enfant, Polowski et sa femme la comblèrent des plus touchantes caresses,¹⁵ et Fœdora n'eut bientôt plus que le souvenir de ses maux.

Plusieurs années s'écoulèrent¹⁶ ainsi sans qu'on apprît (h) rien des parents de Fœdora. Cependant, elle avait grandi en sagesse et en beauté; rien n'avait été négligé¹⁷ pour former au bien son cœur et son esprit. Elle avait alors quinze ans.¹⁸ Chaque année, le jour de sa délivrance était un jour de fête.¹⁹ Durant l'une de ces réunions, tandis que Fœdora racontait de nouveau les accidents de son enfance²⁰ si agitée, et passait en revue tous les bienfaits dont la comblaient tous les jours ses parents d'adoption, on entendit l'explosion d'un coup de feu²¹ parti à quelque distance du château.

Le vent soufflait avec violence,²² la neige tombait à gros

flocons et obscurcissait le ciel de manière à ce qu'on ne pût rien voir à trois pas devant soi.

"C'est quelque voyageur égaré qui demande du secours ou qui est attaqué par les bêtes féroces," car il est impossible de se livrer au plaisir de la chasse par un temps semblable," s'écria Polowski, et il donna l'ordre à ses gens d'aller à sa recherche. Lui-même se mit (i) à la tête du cortège,²⁴ qui se dirigea vers la forêt. Quelque temps après, il reparut. Les domestiques portaient sur un brancard le corps d'un Russe ensanglanté.²⁵ Fœdora se précipita au devant son compatriote; elle-même vent panser sa blessure. Bientôt celui-ci put témoigner sa reconnaissance aux hôtes du château et leur raconter son histoire.

COLLOQUIAL EXERCISE.

1. Où Fœdora fut-elle conduite?
2. Qu'étaient devenus ses compagnons?
3. Où se trouva la petite Moscovite?
4. Que vit-elle soudainement au milieu de la forêt?
5. Que fit Fœdora à l'approche de l'ours?
6. Comment échappa-t-elle à un si grand danger?
7. Que vit alors Fœdora?
8. De quelle manière l'étranger regarda-t-il l'orpheline?
9. Qui était l'étranger?
10. Que fit alors le gentilhomme polonais?
11. Que fit-il pour l'enfant?
12. Par qui Fœdora fut-elle accueillie?
13. Fut-elle longtemps à se rétablir?
14. Que raconta-t-elle à ses bienfaiteurs?
15. Comment Polowski et sa femme traitèrent-ils notre héroïne?
16. Apprit-on bientôt des nouvelles de ses parents?
17. Prit-on soin de son éducation?
18. Quel âge avait-elle?
19. Que faisait-on chaque année?
20. Que faisait Fœdora dans une de ces réunions?
21. Qu'entendit-on alors?
22. Quel temps faisait-il dans ce moment?
23. Que dit Polowski en entendant le coup de feu?
24. Que fit-il alors?
25. Que portaient les domestiques?

NOTES.

- (a) Parvint, reached; from parvenir.
 (b) De sorte que, so that.
 (c) From recueillir.
 (d) Ce qui lui restait de forces, her remaining strength.
 (e) From pouvoir.
 (f) Coup de feu, shot.
 (g) From accueillir.
 (h) From apprendre.
 (i) From mettre.

KEY TO EXERCISES IN LESSONS IN FRENCH.

EXERCISE 147 (Vol. II., page 237).

1. How many rooms do you intend to take? 2. We intend to rent a parlour on the ground floor, and two closets on the third story. 3. Do you not prefer renting a bed-room on the second floor? 4. We prefer living on the ground floor. 5. Can you not remain and dine with us to-day? 6. I thank you, I prefer coming to-morrow. 7. Will your father come and breakfast with us to-morrow? 8. He intends to come to-morrow early. 9. What do you wish to say to them? 10. I wish to beg them to do me that favour. 11. Do you intend to do my brother that favour? 12. I hope so (to do it to him). 13. Do you prefer living up stairs or down stairs? 14. We prefer living down stairs (below). 15. What do you think of doing with that young pheasant? 16. We think of sending it to your brother-in-law. 17. Can you not play on the violin? 18. I can play on it. 19. Can your cousin play on the piano? 20. She can play on the piano and on the harp. 21. Can you not write? 22. We can read, write, and cipher. 23. Can you play the guitar? 24. We cannot play it. 25. We wish to find a suite of rooms on the ground floor.

EXERCISE 148 (Vol. II., page 237).

1. M. votre beau-frère compte-t-il louer le rez-de-chaussée? 2. Il compte louer deux chambres au second. 3. Combien de chambres M. votre fils compte-t-il louer? 4. Il compte louer deux chambres au second. 5. Préfère-t-il demeurer au second? 6. Il préfère demeurer au rez-de-chaussée. 7. M. votre père veut-il venir dîner demain avec nous? 8. Il compte venir demain à deux heures. 9. Préférez-vous demeurer en haut ou en bas? 10. Je préfère demeurer en haut. 11. Mlle votre sœur sait-elle toucher du piano? 12. Elle sait jouer du piano (toucher du piano). 13. Où comptez-vous demeurer? 14. Nous comptons demeurer chez M. votre père. 15. Voulez-vous monter dans ma chambre? 16. Je descendrai chez votre père. 17. Désirez-vous demeurer au rez-de-chaussée? 18. Je désire demeurer au second. 19. Faut-il rester ici? 20. Il n'est pas nécessaire d'y rester. 21. Que pensez-vous faire de votre livre? 22. Je pense le donner à mon fils. 23. Que voulez-vous que je dise à ce monsieur? 24. Je veux que vous le priiez de me faire un plaisir. 25. Voulez-vous envoyer ce faisan à M^{me} votre mère? 26. Je désire le lui envoyer, elle est malade. 27.

elle votre sœur ne sait-elle pas jouer du violon? 28. Elle ne sait pas jouer du violon, mais elle sait jouer de la guitare. 29. Mlle votre sœur désire-t-elle demeurer en haut? 30. Elle préfère demeurer en bas. 31. Ne voulez-vous pas me faire ce plaisir? 32. Je le ferai volontiers (avec plaisir). 33. M. votre frère ne peut-il pas rester à dîner avec nous aujourd'hui? 34. Il a promis à mon père de venir dîner avec lui. 35. Notre ami sait lire, écrire et compter.

EXERCISE 149 (Vol. II., page 237).

1. Why do you not cease reading? 2. I should be wrong to cease reading before knowing my lesson. 3. Have you forbidden your gardener to water those flowers? 4. On the contrary, I had ordered him to water them. 5. Why has he neglected doing it? 6. Because he has forgotten to bring the watering-pot. 7. What does Mr. F. wish to do? 8. He longs to continue the study of medicine. 9. Are you not wrong to visit that gentleman? 10. I should be wrong to neglect him. 11. Have you not refused to render that service to your enemy? 12. I should have been wrong to refuse rendering it to him. 13. What conveyance have you advised us to take? 14. I have advised you to take the steam-boat. 15. Have you threatened to strike that child? 16. I have threatened (him) to correct him. 17. Have you refused to sell goods to my brother? 18. I have refused to sell them to him (any to him) on credit. 19. Have you told my son to repair to my house? 20. I begged him to go straight there. 21. Do you propose coming on Christmas-eve? 22. We propose to come on the next day. 23. Does your companion propose to keep silent (to keep this secret)? 24. He proposes to impart it to every one.

EXERCISE 150 (Vol. II., page 238).

1. Avez-vous défendu à mon cousin de parler au jardinier? 2. Je ne lui ai pas défendu de lui parler. 3. Mme votre mère a-t-elle commandé au jardinier d'arroser ses roses? 4. Elle lui a commandé de les arroser. 5. A-t-il oublié de le faire? 6. Il a négligé de le faire; il ne l'a pas oublié. 7. Quelle voie prendrez-vous pour aller à Paris? 8. Je vous conseille de prendre la voie du chemin de fer. 9. Avez-vous dit à M. votre fils de prendre la voie du bateau à vapeur? 10. Non, Monsieur, je lui ai dit de prendre la diligence. 11. Votre frère n'a-t-il pas tort de négliger de faire visite à son beau-frère? 12. Il a tort de le négliger. 13. Ce jeune Allemand ne brûle-t-il pas de lire cette lettre? 14. Il brûle de continuer ses études. 15. Vous proposez-vous de lui confier cet argent? 16. Je me propose de le lui confier. 17. Négligez-vous de lui reprocher ses fautes? 18. J'évite de les lui reprocher. 19. Avez-vous menacé de punir votre fils? 20. J'ai menacé de le frapper. 21. Ne manquez pas de présenter mes compliments aux amies de ma sœur. 22. Je n'y manquerai pas. 23. Avez-vous refusé de lui vendre des marchandises? 24. J'ai refusé de lui vendre des marchandises à crédit. 25. Quelle voie me conseillez-vous de prendre? 26. Je vous conseille de prendre la voie du chemin de fer. 27. Lui défendez-vous de venir? 28. Je lui ai défendu d'écrire. 29. Avez-vous manqué de payer votre jardinier? 30. Je n'ai pas manqué de le payer. 31. J'ai oublié de vous payer. 32. Ne négligez pas de m'écrire. 33. Dites-lui d'aller trouver mon père. 34. Ne cessez pas de travailler. 35. Dites-lui de venir la veille de Noël. 36. Je lui ai dit de venir le lendemain.

EXERCISE 151 (Vol. II., page 266).

1. Does that arrangement suit you? 2. It does not suit me, but it suits our relation. 3. Does not that displease the painter? 4. Your conduct displeases him much. 5. Do you not fear abusing your friend's patience? 6. I fear to abuse it. 7. Do you never think of your duties? 8. I think of them every day. 9. Have you thought of your brother to-day? 10. I have thought of him, and have remembered his goodness. 11. Has he taken care of his father, and has he obeyed him? 12. He obeys him constantly. 13. Has he never disobeyed him? 14. He has disobeyed him several times, but he grieves for his fault (he avails his fault). 15. Do you not thank them for their kindness? 16. I thank them (for it) with all my heart. 17. Has the saddler congratulated you for your success? 18. He has congratulated me (for it). 19. Have you not laughed at our misfortune? 20. We have not laughed at it; we never laugh at the misfortunes of others. 21. Do you not remember the news which I have told you? 22. I do not recollect it. 23. Has not your father forbidden your slandering your neighbor? 24. He has forbidden it (to me). 25. We have inquired into all the circumstances of that affair.

EXERCISE 152 (Vol. II., page 266).

1. N'avez-vous pas abusé de la complaisance de votre ami? 2. Je n'ai pas abusé de sa complaisance, j'ai abusé de sa patience. 3. Votre conduite ne déplaît-elle pas à vos parents? 4. Ma conduite ne leur plaît pas. 5. Pourquoi n'avez-vous pas obéi à M. votre père? 6. Je lui ai obéi. 7. N'avez-vous pas ri de mes erreurs? 8. Je n'ai pas ri de vos erreurs. 9. Le jeune homme a-t-il ri des erreurs du peintre?

10. Il n'a pas ri de ses erreurs. 11. Votre sellier a-t-il ri des malheurs de votre cousin? 12. Il n'a pas ri de ses malheurs. 13. Riez-vous jamais des malheurs d'autrui? 14. Nous ne rions jamais des malheurs de notre prochain. 15. Vous souvenez-vous de la leçon que vous avez apprise hier? 16. Je ne m'en souviens pas. 17. Cette demoiselle ressemble-t-elle à sa mère? 18. Elle ne ressemble pas à sa mère. 19. Avez-vous remercié votre ami de sa complaisance? 20. Je l'en ai remercié. 21. Mme votre mère vous a-t-elle défendu de lire ce livre? 22. Elle me l'a défendu. 23. Pourquoi ne pardonnez-vous pas à vos ennemis? 24. Je leur pardonne de tout mon cœur. 25. Ne pensez-vous pas à vos devoirs? 26. J'y pense tous les jours. 27. Avez-vous félicité votre ami? 28. Je l'ai félicité de ses succès. 29. N'avez-vous pas médié de ces messieurs? 30. Je ne médiais jamais de mon prochain. 31. Cette maison vous convient-elle? 32. Elle me convient, mais elle ne convient pas à mon père. 33. Cette maison convient-elle au peintre? 34. Elle lui convient très bien, mais elle est trop petite pour moi.

EXERCISE 153 (Vol. II., page 267).

1. Was not that hero enamoured with liberty and glory? 2. He was enamoured with them. 3. Was not that king beloved by his people? 4. He was beloved by them. 5. Are not those merchants pleased with their purchase? 6. They are not pleased with it. 7. Are you not vexed not to be able to accompany us? 8. I am grieved at it. 9. Do you know with what the innkeeper has filled this cask? 10. He has filled it with wine. 11. With what will you have that bottle filled, when you have had it cleaned? 12. It is already filled with ink. 13. Are you not very sorry to have had your apple-trees cut down? 14. I am very glad of it, for they were good for nothing. 15. Is it not necessary to have those plum-trees pulled up? 16. It is not necessary to have them pulled up. 17. Is it possible to split that piece of wood? 18. It is possible to split it. 19. Are you exact (regular) in cleaning your clothes? 20. I am very exact in it. 21. With what have you filled your purse? 22. I have filled it with money. 23. Is it necessary to have your fire-wood sawed? 24. It is necessary to have it sawed. 25. Are you not grateful for the services which are rendered you? 26. I am very grateful for them.

EXERCISE 154 (Vol. II., page 267).

1. N'êtes-vous pas fâché d'avoir perdu votre argent? 2. Je suis chagriné d'avoir perdu ma bourse. 3. De quoi remplirez-vous cette bouteille? 4. Je la ferai remplir d'encre. 5. N'est-il pas nécessaire de faire scier notre bois? 6. Il est nécessaire de faire scier notre bois à brûler. 7. Votre jardin est trop petit; n'est-il pas nécessaire de faire arracher des pruniers? 8. Il est nécessaire de faire abattre des pruniers. 9. Avez-vous rempli d'argent la bourse de votre ami? 10. Je l'ai remplie d'or. 11. Toutes vos bouteilles sont-elles remplies de vin? 12. Elles sont toutes remplies d'encre. 13. Êtes-vous fâché d'avoir rempli d'encre vos bouteilles? 14. Je suis bien aise de les avoir remplies d'encre, car j'ai besoin d'encre. 15. Êtes-vous content de ce livre? 16. J'en suis content. 17. Cette terre est-elle bonne à quelque chose? 18. Elle n'est bonne à rien. 19. Cette dame est-elle chérie de ses enfants? 20. Elle est chérie de ses amis et de ses enfants. 21. Êtes-vous reconnaissant de ses services? 22. J'en suis reconnaissant. 23. N'est-il pas possible de fendre ce morceau de bois? 24. Il n'est pas possible de le fendre. 25. Est-il agréable de voyager en hiver? 26. Il n'est pas si agréable de voyager en hiver qu'en été. 27. Il est facile de blâmer les autres. 28. N'est-il pas glorieux de mourir pour son pays? 29. Il est glorieux de vivre et de mourir pour son pays. 30. En avez-vous rempli l'encrier? 31. Je l'en ai rempli. 32. Ne serait-il pas nécessaire d'arracher tous ces arbres? 33. Il ne serait pas nécessaire de les arracher tous, car mon jardin est très grand. 34. Henri quatre était aimé de son peuple.

EXERCISE 155 (Vol. II., page 277).

1. Have you not shut the front door? 2. We have shut it, but we have not shut the back door. 3. Who arrived before me? 4. The gentleman who is sitting before the window. 5. Who lives behind your house? 6. There is no house behind ours. 7. Do you not think that by dint of working (by constant labour) he will grow rich? 8. I do not believe that he will grow rich, if he sells his goods so cheap. 9. Does he learn music without the knowledge of his parents? 10. He learns it without their knowledge. 11. Did you marry without your sister's knowledge? 12. I married without her knowledge. 13. Our friend is not in the house, he is out (without, outside). 14. He is not out of the city, he is within. 15. Have you money about you? 16. I have no money about me. 17. Do you live in the back or in the front of the house? 18. We live in the front. 19. Has the cook put the plates upon the table, or under? 20. She has put the plates, dishes, spoons, and forks on the table. 21. How much do those potatoes cost you? 22. I bought them at the rate of five francs the hectolitre. 23. Have you had the inside or the outside of the house repaired? 24. I have had the interior and the exterior repaired.

MECHANICS.—VIII.

INTRODUCTION TO THE MECHANICAL POWERS.

In the account given of parallel forces in Lesson IV., such only were considered as act in the same direction, pull or push together, each adding to the effect of every other; and of these the subject of the centre of gravity in Lessons V. and VI. furnished numerous exemplifications, the forces all pulling towards the earth's centre.

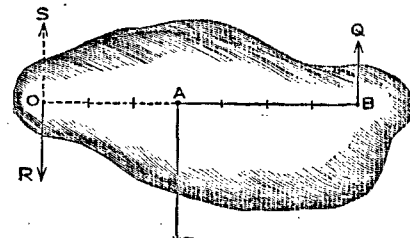


Fig. 43.

Suppose two such applied to a body, as in Fig. 43, where A and B are the points of application, and the arrows A P, B Q, represent their magnitudes and directions. Let A P be 7 pounds and B Q 3 pounds; how can we find their resultant? From a very simple consideration. Whatever it be, or at whatever point it acts, it must be such that a force at that point, equal and opposite to it, will balance it, and therefore make equilibrium with its components A P, B Q. Now, that point cannot be inside the line A B, for in that case the resultant of the two which pull together could not be opposite to the third. The point must, therefore, be outside A B, and on the side of the greater force A P. Let the point, therefore, be O, and O R the resultant, O S being the force equal and opposite to it, which makes equilibrium with A P and B Q.

Then, since there is equilibrium, the resultant of the two that pull together, B Q and O S, must be equal and opposite to A P; and therefore, as proved in Lesson IV., A P is the sum of B Q and O S. But A P being 7 pounds, and B Q 3 pounds, O S must be 4 pounds, the difference of these forces. The resultant in magnitude, therefore, is the difference of the components.

Now for the point of application. Since the resultant of 4 pounds at O and 3 pounds at B must cut B O at A inversely as the forces, if I divide A B into four equal parts, three of them will be in A O; or, which is the same thing, seven parts in B O and three parts in A O, showing that O is the point whose distances from A and B are inversely as the forces. Putting all together, we learn that—1. The Resultant of two Unequal Parallel Forces which act at two points of a body in opposite directions is equal in magnitude to their difference. 2. Its point of application is outside of the greater force, at distances from the points of application of the components, which are inversely as these forces.

The rule to be observed practically in finding this centre is, to cut A B into as many equal parts as there are pounds, or other units, or fractions of a unit, in the difference of the forces, and then to measure outwards from A along the production of A B as many of these parts as there are pounds or other units in B Q; the point O so obtained is the parallel centre required. And you see that what is thus proved for the numbers 3 and 7 must hold equally for other numbers, whatever they be.

There is one particular case of this principle, which I shall just notice. Suppose A P becomes equal to B Q; what of their resultant? how large is it, and where applied? In magnitude it is nothing, being the difference of the forces; and the point of application is nowhere, at least within reach; for on A B produced no point O can be found such that A O be equal to B O. Pairs of forces of this kind are termed "couples," and they play an important part in Mechanics, in producing a tendency to rotation; but we shall not consider them here.

One consequence more: How find the resultant of any number of parallel forces, some acting in one direction, others in the opposite? Evidently by compounding separately, and finding the centres of, those which act in the opposite directions. You thus get two single parallel and opposite forces the resultants of the opposing sets, and their centres of application; and therefore, by the aid of the principle above established, learn that—

1. The Resultant of a system of Parallel Forces, which act,

some in one direction, others in the opposite, is in magnitude the Difference of the Sums of the Opposing sets of Forces.

2. Its Point of Application is had by finding the parallel centre of each opposing set, and taking a point on the side of the greater sum, on the production of the line joining these centres whose distances from these points are inversely as the sums of the opposing forces.

For example: Suppose eight parallel forces are applied to the eight corners of a box, five of 2, 4, 6, 7, and 9 pounds directed to the east, and three of 10, 11, and 15 pounds to the west; the resultant will be 8 pounds, acting towards the west and at a point on the line joining the parallel centres of the two sets, and outside the greater, whose distances from these centres are inversely as 36 to 28.

These principles, with others previously established, we now apply to the Lever; first taking the cases in which the forces, usually termed the "Power" and the "Resistance," or "Weight," are parallel. The principle of leverage may be understood by the aid of Fig. 44. Two balls, say of iron, connected by a thin bar, are supported by a cord at a point O. How is this point to be selected so that the balls may equally balance each other, the weight of the rod not being taken into consideration? Again, having recourse to numbers, let the balls be 13 pounds and 4 pounds, and their centres the points A and B; how is O to be found? Evidently by cutting A B so that A O be to B O inversely as 13 to 4; or, on dividing that line into seventeen equal parts, so that four of them be in A O and thirteen in B O. If the bar be supported by the cord from above, or by a prop from below, at this point there is equilibrium. This is the principle of the Lever, of which the ball B may be considered the Power, and the ball A the Resistance. We say, therefore, that the support, or prop, commonly called the "fulcrum," must be so placed that the arms A O, B O of the lever on each side of it be to one another inversely as the Power and Resistance.

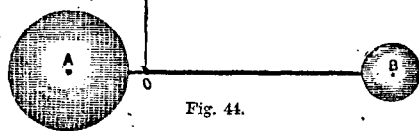


Fig. 44.

But, as inverse ratio puzzles some persons, I shall put the matter in another light. You observe that at the end, A, of this lever, there are only 4 equal parts in the arm, but 13 pounds in the resistance, while in the arm B O the parts are 13, and the pounds only 4. Now, suppose the parts were all inches, then if you at either end multiply the number of inches in an arm by the number of pounds on that arm, you get the same number—namely, 52, for product. Choose any other numbers different for 13 and 4, and the result is the same; the numbers at either end multiplied together give the same product. Therefore, another way of stating the Condition of Equilibrium in a lever is, that the product of the Power and arm on one side should be equal to that of the Resistance and arm on the other.

But here be careful to be clear as to what is meant by "the product of Power and arm, Resistance and arm." This puzzles some persons extremely, from its never being clearly explained to them. Strictly speaking, the product of a force and a line, or of a resistance and an arm, is nonsense. Multiply a bag of flour by the iron beam from the end of which it hangs, and who can divine what the result of the operation is to be? Neither flour nor iron, but something between! Well, then, to remove every possibility of confusion on this point, keep in mind (as the example above shows) that we multiply numbers only, not the Power and its arm, or the Resistance and its arm, but the NUMBER which denotes the units of FORCE in one, by the NUMBER which denotes the units of LENGTH in the other. Then you can make no mistake; there will be no confusion; and you can still say, knowing the meaning of your words, that the Power multiplied by its arm is equal to the Resistance multiplied by the other arm. This product is commonly termed the "Moment" of the Power or Resistance, and the Condition of Equilibrium is stated as follows:—

For Equilibrium in a Lever the Moments of the Power, with reference to the fulcrum, and Resistance should be equal.

LESSONS IN GEOGRAPHY.—XXXIII.

AFRICA.

AFRICA, the mystery of ancient and the problem of modern times, is the south-western part of the Old World. This continent is situated chiefly in the torrid zone, the exceptions being Egypt, Barbary, and the British colonies at the Cape of Good Hope. The central regions and the coast on the eastern and western sides were considered as almost wholly uninhabitable by the ancients, as far as they chanced to be acquainted with them, and with regard to Europeans these districts have not greatly improved in character in this respect at the present day; although, judging by the accounts of all the recent exploring expeditions into its interior, there is a bright future yet in store for the negro races of Africa, who are fitted to endure the intense heat, the heavy periodical rains, and the fever-fraught exhalations of the marshy districts of the land in which an all-wise Creator has placed them, when intercourse with English traders shall have awakened them to the benefits that civilisation and the arts of peace, agriculture, and commerce bring to every land that uses them aright.

Extent.—Africa extends from north to south about 5,000 miles; the most northern point being a head-land of Tunis, called Ras-al-Krum, in lat. 37° 20' N., and long. 9° 48' E.; and the most southern point, Cape Agulhas, in lat. 34° 50' S. and long. 19° 57' E. It extends also from west to east about 4,600 miles; the most western point being Cape Verd, in lat. 14° 45' N. and long. 17° 32' W.; and the most eastern point, Cape Guardafui, in lat. 11° 41' N., and long. 51° 22' E. The equator, passing over the Gulf of Guinea, crosses this continent over Lower Guinea on the west, near the island of St. Thomas and mouth of the Gaboon River, and over Zanguebar on the east, near the mouth of the river Juba; it thus cuts off about one-third of this continent to the south in the form of a peninsula; the Tropic of Capricorn cuts off from this peninsula, in like manner, a smaller one, containing Cape Colony and Kaffraria. The Tropic of Cancer cuts off Northern Africa, crossing Sahara, or the Great Desert, and the Libyan Desert, and dividing Egypt from Nubia. Between the two tropics, and between the meridians of 10° and 30° E.—that is, nearly those of Tunis and Alexandria—there is a vast tract of unexplored country, especially south of the equator, which is little less than one-half of the continent; the only parts of this vast region which have been partially explored being, firstly, the countries that lie around Lake Tchad; secondly, the regions in which lie the great equatorial lakes of Africa—namely, Lake Victoria Nyanza, discovered by Captain Speke; Lake Albert Nyanza, discovered by Sir Samuel Baker; and Lake Tanganyika, discovered by Captains Burton and Speke; and thirdly, the countries between the parallels of 5° and 25° S. latitude, which have been traversed in their breadth from the Indian Ocean to the Atlantic Ocean, and in their length from the Kaleshari Desert to the equatorial districts west of the great lakes—about which

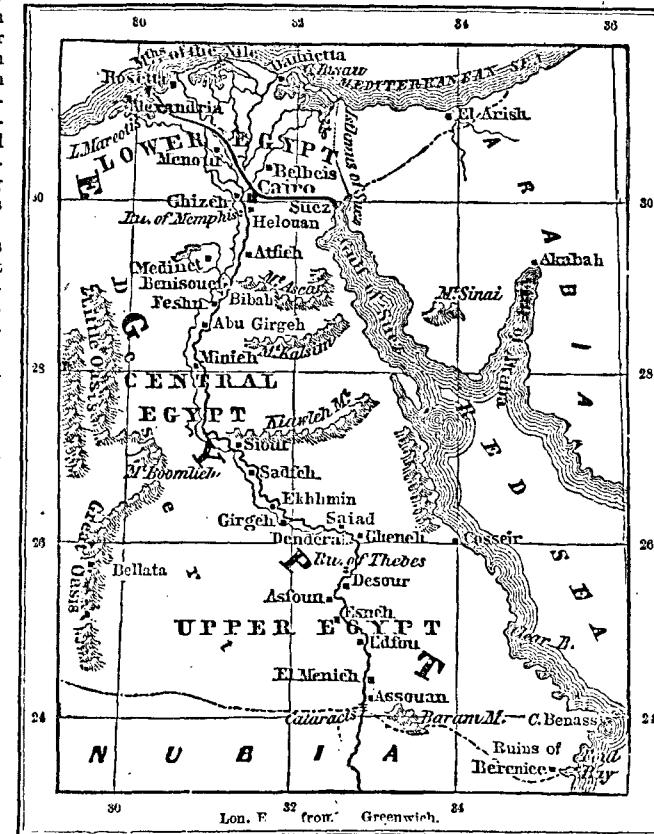
we have yet so much to learn—by the indefatigable and adventurous Livingstone, by Stanley, and by other explorers.

The surface of the whole continent is reckoned to contain nearly 11,000,000 square miles, and about 200,000,000 inhabitants; which gives on an average about eighteen to every square mile.

Boundaries.—Africa is bounded on the north by the Mediterranean Sea; on the south by the great Southern Ocean, or rather the waste of waters in which the South Atlantic Ocean and Indian Ocean meet, lying to the north of the Antarctic Ocean; on the west by the South Atlantic Ocean; and on the east by the Indian Ocean.

Oceans, Seas, Gulfs, etc.—The Red Sea and the Gulf of Aden lie to the north-east of this continent; and the Mozambique Channel, 250 miles in width at its narrowest part, to the east, between the south-east coast and Madagascar. The South Atlantic and the Indian Oceans commingle their waters south of the Cape of Good Hope; the Atlantic washes the shores of Guinea and Lower Guinea, in the Gulf of Guinea, and the Bights or Bays of Benin and Biafra. The Strait of Gibraltar separates the rocky coast of Morocco and Spain. In the Mediterranean are the Gulfs of Sidra and Cabes, on the north of Tripoli and Tunis; and in the south, on the shores of Cape Colony, are St. Helena Bay, Table Bay, False Bay, Algoa Bay, etc.; while on the east coast are Delagoa Bay, Sofala Bay, and many others of less extent and importance.

Islands.—The principal of the African islands, Madagascar of course being excepted, lie in small groups and clusters. The Azores, which are usually reckoned as African islands, though they lie above the latitude of the most northerly point of Africa, and in the latitude of Portugal, to which they belong, are about 800 miles to the west of the last-named part of the mainland of Europe. Madeira, which also belongs to Portugal, and Porto Santo, lie off the west coast of Morocco. The Canaries, belonging to Spain, of which the chief are Teneriffe and Grand Canary—the former remarkable for its high mountain, called the Peak of Teneriffe, which rises to the altitude of 12,180 feet above the level of the sea, or rather more than 2½ miles of perpendicular height—lie off the north-western corner of that part of the Sahara that abuts on the Atlantic. Of the Cape Verd Islands, the chief are Santiago and St. Vincent; the chief town of the former being Porto Praya, formerly the seat of government, which has been transferred to Porto Grande, the chief town in the latter. Among the tropical islands should be reckoned Fernando Po, Prince Island, St. Thomas Island, and Annabon, all in the Gulf of Guinea. Ascension Island and St. Helena—the spot on which the Emperor Napoleon fretted through the last few years of his existence—lie out in the midst of the South Atlantic Ocean. Madagascar, in the Indian Ocean, is about 1,050 miles long, and about 360 miles broad in its widest part; it is reckoned to contain about 228,000 square miles. The population is reckoned to be about 3,000,000. The Isle of Bourbon, or Réunion, belonging to France, lies about 400 miles eastward of



Madagascar, contains about 970 square miles, and has a population of upwards of 200,000. Mauritius, belonging to Great Britain, is about 115 miles north-east of Bourbon, contains 713 square miles, and has a population of about 370,000. Attached to it in government are the Seychelles or Mahé Islands, the Amirante Islands to the north of Madagascar, and Rodrigues, about 300 miles east of the Mauritius. The Comoro Islands are situated in the Mozambique Channel, Pemba Island and Zanzibar Island off the coast of Zanguebar, and the island of Socotra about 130 miles east of Cape Guardafui, being about 80 miles long, and having a surface of nearly 1,200 square miles.

Capes, Headlands, and Promontories.—The capes, headlands, and promontories of Africa form some of its most remarkable features. On the north is Cape Ceuta (the ancient *Abyla*), a high promontory jutting out into the sea, and terminating in perpendicular rocks; this promontory lies directly opposite the rock of Gibraltar (the ancient *Calpe*), in the Strait of Gibraltar; and these two rocky headlands, flanking the water-way from the land-encircled Mediterranean Sea into the open expanse of the Atlantic Ocean, were denominated by the ancients the Pillars of Hercules. In the Mediterranean, eastward from these, are Ras-al-Krun, Cape Blanco, and Cape Bon; and westward and southward, in the Atlantic, are Cape Sparte, Cape Cantin, Cape Nun, Cape Bojador, Cape Blanco, Cape Verd, Cape Roxo, Cape Sierra Leone, Cape Palmas, Cape Three Points, Cape Formosa, all north of the equator; south of this line are Cape Lopez, Cape Negro, Cape Frio, and Cape Voltas; while doubling the Cape of Good Hope, are to be seen False Cape, Cape Agulhas, Cape Natal, and others on the south coast of Africa. Ascending the east coast, towards the equator, occur Cape Corrientes, Cape St. Sebastian, Cape Delgad, and a variety of other capes called by the common name of *Ras*, which signifies *head* (originally from the Hebrew), just as *cape* signifies *head*, from the Latin *caput*. In the Red Sea, the entrance to which is by the strait of Bab-el-mandeb, there are a variety of capes known by the same appellation, *Ras*, but they are too minute for a general view; and of the Isthmus of Suez, common to Africa and Asia, we have formerly had occasion to speak.

The mountains of Africa, as far as the interior is concerned, are scarcely known. In the northern part of this continent are the celebrated mountains, long known by the name of Atlas, and as having originated the name Atlantic, still applied to the surrounding ocean. These mountains run through the Barbary states, and separate them from the Great Desert; they vary in elevation from 3,000 or 4,000 to 11,400 feet, the latter being among the highest points, and situated near the city of Morocco. Through Abyssinia runs another range, separated by deep valleys and gorges into ranges, groups, and sometimes isolated peaks, of which the most elevated rise to the height of 15,000 feet above the level of the sea.

In Western Africa are to be found the Kong Mountains; and in Eastern Africa, the mountains Kilimanjaro, Mfumbiro, and Kenia, each of which is from 10,000 to 20,000 feet high, and connected with vast interior mountain ranges, called by some the Mountains of the Moon, and by others the Blue Mountains, the whole forming a rampart round the outer edge of the inland basin which contains the great equatorial lakes. Within the limits of Cape Colony there are ranges of mountains rising from the coast towards the interior in a series of precipitous steep slopes and plateaus, that form a succession of what may be termed gigantic steps. These terraces, with the mountain slopes that edge them towards the south, are three in number, namely, the Swellendam Mountains, near the coast, of which Table Mountain, 3,582 feet high, forms a part; the Swarte, or Black Mountains, further inland; and a third range in the interior, which is known by different names in different parts of the chain, being called the Nieuwveld Mountains in the west, Sneewbergen in the centre, and Drakensberg in the east. Some peaks of the Drakensberg attain a height of 10,000 feet, and form the culminating points of Southern Africa.

Table-lands, Plains, Deserts.—The table-lands, plains, and deserts in this continent are immense and to a great extent unexplored. Sahara, or the Great Desert, is a vast plateau, varying in elevation from 1,000 to 5,000 feet in height, with valleys and oases, or fertile tracts of land, intervening at distant intervals, to relieve the general monotony and sterility. Its length is about 3,000 miles, and its breadth in some places exceeds 1,000 miles; it stretches from the shores of the Atlantic

to the hills which border the valley of the Nile on the west. Eastward of that river, and stretching to the shores of the Red Sea, are the deserts of Egypt and Nubia, high plateaus traversed by ranges of mountains, in which are formed the torrent beds which create the annual inundations, and fertilise the valleys of those countries. In the south of Africa, between the parallels 22° and 27° S. lat., is the Kalahari Desert, a vast elevated plateau 3,500 feet above the level of the sea, from which the ground slopes on either side towards the sea.

Lakes.—In Central Africa lies the great basin of Lake Tchad, several thousand square miles in surface, varying with the seasons, and receiving some small tributary streams. This lake is surrounded by the kingdoms—if kingdoms they may be called—of Kanem, Bornou, Bagirmi or Begharmi, and Waday. It is the centre of a rich, fertile, and prosperous country. To the east of Lake Tchad is Lake Fittre; and near Timbuctoo, on the west, is a small sheet of water through which the main stream of the Niger runs, called Lake Debo or Dibble. In Dahomey are the small lakes Avon and Denham. In the southern part of the continent are Lake Ngami, Lake Dilolo, Lake Nyassa, Lake Shirwa, and Lake Shuia—all discovered or explored by Livingstone. On the equator, and to the south of it on the eastern side, are Lakes Victoria Nyanza, Albert Nyanza, and Tanganyika, the first discovered by Captain Speke, Tanganyika by Captains Speke and Burton, and Albert Nyanza by Sir Samuel Baker. In Abyssinia is Lake Dembeba.

Rivers.—The principal river in Africa is the celebrated Nile; it consists at first of two great arms called the Bahr-el-Azrek, or Blue Nile, fed by head-streams that rise in Abyssinia, and the Bahr-el-Abiad, or White Nile, which derives its waters from Central Africa. It was thought when the Victoria Nyanza was discovered by Speke that the great reservoir that supplied the Nile had been discovered. It was, however, found by Sir Samuel Baker, a few months after, that the Nile issued from Lake Albert Nyanza, the Victoria Nyanza emptying itself into this sheet of water by a short broad stream, called the Somerset. The true origin of this river has occupied the attention of many of the world's most noted travellers and explorers during the present century, and foremost in the list of those who have devoted their lives and energies to the great work must be placed the name of David Livingstone, who, after years of unprecedented toil and sacrifice, died in 1873, just when his labour seemed about to be crowned with success. The course of the Nile may be estimated at from 2,500 to 3,000 miles in length. The chief rivers of Eastern and Southern Africa, following the coast from Cape Guardafui, are the Juba, Pangany, Zambesi, Limpopo, Elephant River, Great Orange River, Coanza, Congo, and Gaboon. On the west coast of Africa are the following rivers of considerable note, and no small value in this part of the continent.—The Senegal of 1,000 miles, and the Gambia of the same length, both watering the district Senegambia, whose appellation is formed by their united names; and the Quorra, Joliba, or Niger, about 2,300 miles in length, rising in Nigritia or Soudan, and falling into the Bight of Benin.

With this lesson we give our readers a map of Egypt, a country to which the attention of the public has of late years been frequently directed—as, for instance, on the occasion of the opening of the Suez Canal—and in whose fortunes Great Britain is closely interested.

SUMMARY OF BOUNDARIES.
North: The Mediterranean.
South: South Atlantic Ocean and Indian Ocean.

East: Red Sea, Indian Ocean.
West: The Atlantic Ocean.

SUMMARY OF OCEANS, SEAS, GULFS, ETC.

Atlantic, W. and S. of Africa.
Indian Ocean, E. of Africa.
Red Sea, E. of Africa.

SUMMARY OF ISTHMI.
Mediterranean Sea, N. of Africa.

Gulf of Sidra, Mediterranean.
Gulf of Cabes, Mediterranean.

Gulf of Guinea, S. of Guinea.
Bight of Benin, Gulf of Guinea.

Bight of Biafra, Gulf of Guinea.
St. Helena Bay, Cape Colony.
Saldanha Bay, Cape Colony.

Table Bay, Cape Town.
False Bay, Cape of Good Hope.
Algoa Bay, Cape Colony.
Delagoa Bay, N. of Natal.
Sofala Bay, Sofala.
Mozambique Channel, E. of Sofala.
Gulf of Aden, S.E. of Red Sea.

SUMMARY OF STRAITS.
Gibraltar, Mediterranean.
Bab-el-Mandeb, Red Sea.

SUMMARY OF ISTHMI.
Suez, between Mediterranean Sea and Red Sea, connecting Asia and Africa, and crossed by railway and the great Suez Canal.

SUMMARY OF ISLANDS.
The Azores, W. of Portugal.
Madeira, W. of Morocco.

Porto Santo, N.E. of Madeira.
The Canaries, S. of Madeira.
The Cape Verd Is., W. of Cape Verd.
Ascension I., S. of Sierra Leone.
St. Helena, S.E. of Ascension.
Fernando Po, Bight of Biafra.
Prince Island, S. of Fernando Po.
St. Thomas, S. of Prince Island.
Annabon, S. of St. Thomas.
Madagascar, E. of Sofala and Mozambique.

Bourbon, E. of Madagascar.
Mauritius, N.E. of Bourbon.
Rodrigues, E. of Mauritius.
The Comoro Is., N.W. of Madagascar.
The Amirante Is., N.E. of Madagascar.
The Seychelle Is., N.E. of Amirante.
Socotra, E. of Cape Guardafui.

SUMMARY OF CAPES.

Ras-al-Krun, Tunis.
Bon, Tunis.
Spartel, Morocco.
Bojador, W. of Africa.
Blanco, W. of Africa.
Verd, Senegambia.
Palmas, Guinea.
Three Points, Guinea.
Negro, Benguela.
Good Hope, False Bay.
Agulhas, E. of Cape of Good Hope.
Natal, Caffraria.
Corrientes, Sofala.
Delgado, Zanguebar.
Guardafui, Ajan.

SUMMARY OF MOUNTAINS.
Atlas Mountains, Morocco.
Mountains of the Moon, or Blue Mountains, Central Africa.
Kong Mountains, S. of Soudan.
Swellendam Mountains, C. Colony.
Swarte Mountains, Cape Colony.
Nieuwveld, Sneewbergen, and Drakensberg Mountains, C. Colony.

SUMMARY OF DESERTS.
Sahara or Great Desert.
Libyan Desert.
Kalahari Desert.

SUMMARY OF LAKES.
Tchad, Bornou, Nigritia or Soudan.
Fittre, Waday, Nigritia.
Dembeba, Abyssinia.
Albert Nyanza, Equatorial Africa.
Victoria Nyanza, Equatorial Africa.
Tanganyika, Equatorial Africa.
Nyassa, South Africa.
Shirwa, South Africa.
Ngami, South Africa.

SUMMARY OF RIVERS.
Nile, Equatorial Africa, Abyssinia, and Egypt.
Zambesi, Eastern Africa.
Limpopo, Eastern Africa.
Great Orange River, Southern Africa.
Coanza River, Western Africa (S.).
Congo River, Western Africa (S.).
Gaboon River, Western Africa (S.).
Niger, Western Africa (N.).
Gambia, Western Africa (N.).
Senegal, Western Africa (N.).

LESSONS IN LATIN.—XXXIII.

DEPONENT VERBS (continued)—CONSTRUCTION OF TIMEO.

I HAVE spoken of *verecor* and *metuo*: I will say a few words on *timeo*. *Timeo* (timere, timui, 2) is given in the dictionaries as signifying *I fear*. Is it, then, of the same meaning with *verecor* and *metuo*? Not exactly. *Timere* represents a state of mind, an habitual state of mind, a state of mind habitual because natural, the state of mind which is designated *timid*; hence *timere* has for its primitive import to be *timid* or *afraid*. Accordingly *timere* denotes mental solicitude, to be anxious, to be afraid, to be apprehensive. *Metuere* points out a more active, more decided, and more formidable sentiment. There is between *metuere* and *timere* the difference that there is between the English to be *afraid* and to *fear*—we are afraid harm has come to our friends, and we fear the lightning. Hence we may understand these words, *metui cupiant, metuique timent, they wish to be feared, and they are afraid to be feared*. When I add that the words are used of tyrants, you will see that they are very descriptive.

CONSTRUCTION OF "TIMEO."

Accusative of object. Instead of an accusative, *timeo*, like many other verbs, may have as its object a member of a sentence, or a dependent and imperfect sentence; *ne* and *ut*; with dative of object for which or whom you are afraid.

Accusative:—
"Si coactus esset respicere ac timere oppidanos."—*The Gallic War*.
Lit. Trans.—"If he had been compelled to regard and fear the town's people."
"Id. Trans."—"If he were compelled to regard and fear the town's people."

Here you see the literal translation and the idiomatic are very nearly the same—showing you that the Latin and the English may exactly correspond in both word and order.

With a dependent member:—
"Hec quo sint eruptura timeo."—*Cicero*.
Lit. Trans.—"These things where they may break out I am afraid."
Id. Trans.—"I fear what may be the issue of these things."

With ne:—
"Timeo ne malefacta mea sint inventa omnia."—*Plautus*.

Lit. Trans.—"I am afraid lest bad deeds may be discovered all."
Id. Trans.—"I am afraid that all my bad deeds are discovered."

With ut:—
"Omnis labores to excipere video; timeo ut sustineas."—*Cicero*.
Lit. Trans.—"All labours thee to undertake I see; I fear that thou may support."
Id. Trans.—"I see that you undertake all labours; I fear you will not be able to support them."

With dative:—
"Nostrae causae nihil nos timere."—*Quintilian*.
Lit. Trans.—"For our cause nothing we fear."
Id. Trans.—"We (say that we) fear not at all on our account."

VOCABULARY.

Angustia, -arum, f., narrowness.	Conor, dep. 1, I endeavour.	pertussum (dep. 4), I maketrial of (E. R. experiment, experience).
Angustiae itineris, the narrow road.	De suo ac legionis periculo, concerning (on account of) his own peril and the peril of the legion.	Objicio, 3, I cast in the way of, I oppose to.
Circumvenio (circum and venio), 4, I surround (E. R. circumvent).	Experior, experiri, ex-	Res frumentaria, corn for horses and men.
		Supporto, 1, I carry.

EXERCISE 117.—LATIN-ENGLISH.

1. Caesar timebat tantae magnitudinis flumini exercitum objicere. 2. Caesar conandum atque experendum judicat. 3. Caesar, etsi timebat tantae magnitudinis flumini exercitum objicere, conandum tamen atque experendum judicat. 4. Neque timent ne circumvenirentur. 5. Non se hostem vereri dicebant. 6. Angustiae itineris timere se dicebant. 7. Ut satis commode supportari res frumentaria timere dicebant. 8. Non se hostem timere, sed angustiae itineris, et ut satis commode posset supportari res frumentaria timere dicebant. 9. Salva est navis, ne time. 10. De Republica valde timeo. 11. De suo ac legionibus periculo nihil timebat. 12. Non times ne locum perdas. 13. Timuit ne non succederet.

EXERCISE 118.—ENGLISH-LATIN.

1. I fear that thou hast lost thy labour. 2. I am afraid the house will fall. 3. I fear corn will not be brought into the city. 4. The general feared that his army would not come. 5. They fear for their beautiful little girl. 6. Concerning thy fortune, I am not at all afraid. 7. The king and his generals are afraid of being surrounded. 8. Cicero judges that he must make a trial. 9. I fear he will not be able to make a trial.

DEPONENT VERBS.—FOURTH CONJUGATION.

EXAMPLE.—Blandior, I flatter.

Chief Parts: Blandior, blandiri, blanditus sum.

PRESENT TENSE.

Indicative.	Subjunctive.	Imperative.	Infinitive, Participles.
Sing. Blandior, I flatter, etc.	Blandiar, I may flatter.	Blandire, or blanditor, flatter thou, etc.	Blandiri, Blandiens, to flatter, flattering.
Blandiris.	Blandiaris.		
Blanditur.	Blandiatur.	Blanditor.	
Plu. Blandimur.	Blandiamur.	[diminor.]	
Blandimini.	Blandiamini.	Blandimini, blandiantur.	
Blandiuntur.	Blandiantur.		

IMPERFECT TENSE.

Sing. Blandiebar, I was flattering, etc.	Blandirer, I might flatter.
Blandiebaris.	Blandireris.
Blandiebatur.	Blandiretur.
Plu. Blandiebamur.	Blandiremur.
Blandiebamini.	Blandiremini.
Blandiebantur.	Blandirentur.

FIRST FUTURE TENSE.

Sing. Blandiar, I shall flatter, etc.	Blandituro, I shall flatter, etc.
Blandiaris.	Blandituro.
Blandietur.	Blandituro.
Plu. Blandiemur.	Blandietur.
Blandiemini.	Blandietur.
Blandientur.	Blandietur.

PERFECT TENSE.

Sing. Blanditus sum, I have flattered, etc.	Blanditus sis, I may have flattered, etc.	Blanditus, having flattered
Blanditus es.	Blanditus sis.	
Blanditus est.	Blanditus sit.	
Plu. Blanditi sumus.	Blanditi sitis.	
Blanditi estis.	Blanditi sitis.	
Blanditi sunt.	Blanditi sint.	

15. Reduce $\frac{1}{2ab}, \frac{2}{3bc}, \frac{3}{4cd}, \frac{4}{5de}$, and $\frac{5}{6ef}$ to fractions having a common denominator.

132. To reduce an improper fraction to a whole or mixed quantity.

Divide the numerator by the denominator, the quotient with the remainder in a fractional form is the answer. [See Art. 106.]

133. To reduce a mixed quantity to an improper fraction. Multiply the integer by the given denominator, and add the given numerator to the product. [See Art. 122.] The sum will be the required numerator; and this placed over the given denominator will form the improper fraction required.

If the sign before the dividing line is —, all the signs in the numerator must be changed. [See Art. 124.]

EXERCISE 16.

1. Reduce $\frac{ab+bm+d}{b}$ to a whole or mixed quantity.
2. Reduce $\frac{am-a+ady-hr}{a}$ to a whole or mixed quantity.
3. Reduce $a + \frac{1}{b}$ to an improper fraction.
4. Reduce $a - \frac{b}{c}$ to an improper fraction.
5. Reduce $ab - \frac{a-c}{x}$ to an improper fraction.
6. Reduce $m + d - \frac{r}{h-d}$ to an improper fraction.
7. Reduce $x - \frac{a+b}{c}$ to an improper fraction.
8. Reduce $ax + \frac{a-b}{d}$ to an improper fraction.
9. Reduce $b - \frac{c}{d-y}$ to an improper fraction.
10. Reduce $x^2 + ax + a^2 + \frac{a^3}{x-a}$ to an improper fraction.
11. Reduce $2x - 4a + \frac{7a^2}{x+2a}$ to an improper fraction.
12. Reduce $3a - 4x + \frac{25ax-12a^3}{4a-3x}$ to an improper fraction.
13. Reduce $1 - \frac{x-a}{x+a}$ to an improper fraction.

134. To reduce a compound fraction to a simple one. Multiply all the numerators together for a new numerator, and all the denominators for a new denominator.

EXERCISE 17.

1. Reduce $\frac{2}{7}$ of $\frac{a}{b+2}$ to a simple fraction.
2. Reduce $\frac{2}{3}$ of $\frac{4}{5}$ of $\frac{l+h}{2a-m}$ to a simple fraction.
3. Reduce $\frac{a^2}{b}$ of $\frac{c^3}{d^2}$ of $\frac{e^4}{f^3}$ to a simple fraction.
4. Reduce $\frac{a^2}{b}$ of $\frac{c^3}{d^2}$ of $\frac{e^4}{f^3}$ to a simple fraction.
5. Reduce $\frac{x^2-ax+a^2}{x^2+ax+a^2}$ of $\frac{x+a}{x-a}$ to a simple fraction.
6. Reduce $\frac{3x^2-4x+1}{x^2+4x-3}$ of $\frac{3x+4}{x-4}$ to a simple fraction.
7. Reduce $\frac{1}{7}$ of $\frac{1}{3}$ of $\frac{1}{8-a}$ to a simple fraction.
8. What is the value of $\frac{8axy}{2axy}$?
9. What is the value of $\frac{aabbccddff}{abedf}$?
10. What is the value of $\frac{ab}{a} \times 4$?
11. What is the value of $\frac{16axy}{a} \div 4x$?
12. What is the value of $\frac{16ax}{2a}$ when the denominator is multiplied by 4?
13. What is the value of $\frac{3axy}{24ax}$ when the denominator is divided by 6ax?
14. What is the value of $\frac{17abx}{34a}$ when both numerator and denominator are $\times 2d$?
15. Reduce $\frac{6abc+12abx}{2ab}$ to a whole or mixed number.

16. Reduce $\frac{24xy-48az}{12xy}$ to a whole number.

17. Reduce $\frac{ab+c+dx+ax+am}{a}$ to a whole or mixed number.

18. Reduce the four next examples to their lowest terms:—
(1.) $\frac{abc}{aac}$ (2.) $\frac{3xy}{12xyy}$ (3.) $\frac{bx+by}{ab+bx}$ (4.) $\frac{aaxy-aab}{ac+abc}$

19. Reduce $\frac{ax}{y}$ and $\frac{c}{d}$ to a common denominator.

20. Reduce $\frac{a}{b}, \frac{c}{d}, \frac{f}{g}$, and $\frac{x}{y}$ to a common denominator.

21. Reduce $a - \frac{b+c}{x}$ to an improper fraction.

22. Reduce $a + b - \frac{x-y}{4m}$ to an improper fraction.

23. Reduce $\frac{2}{3}$ of $\frac{a}{b}$ of $\frac{c}{d}$ of $\frac{x}{y}$ to a simple fraction.

24. Reduce $\frac{3}{7}$ of $\frac{2x}{4b}$ of $\frac{2c}{2a}$ of $\frac{4de}{2a}$ of $\frac{abc}{2d}$ to a simple fraction.

KEY TO EXERCISES IN LESSONS IN ALGEBRA.

EXERCISE 13.

1. $\frac{3m}{4y}$
2. $\frac{1}{r}$
3. $\frac{1}{m}$
4. $\frac{a}{b}$
5. $\frac{r+1}{h-1}$

EXERCISE 14.

1. $\frac{2x}{1}$
2. $\frac{3a+4a^2}{5}$
3. $\frac{4a^3-6ay+3y^3}{3a+2y}$
4. $\frac{x^3-ax+a^2}{x+a}$
5. $\frac{x^2+ax+a^2}{1}$
6. $\frac{4a^2+6ab+9b^2}{2a+3b}$
7. $\frac{3x^4-x^3-x+3}{x^2-6x+1}$
8. $\frac{x^3+x^2-2}{2x^2+2x+1}$
9. $\frac{6x^2+8x-1}{x^2+8x-10}$
10. $\frac{4x^2+9x+1}{2x^2-3x-2}$
11. $\frac{4x^3-x^2-3x+2}{3x^3-x^2-3x+3}$

READINGS IN GERMAN.—IX.

10.—Die Rose und die Lilie

Dee ro' zai zōnt dee lee'-li-ai.

Malvina stand mit ihrem Vater vor einer Lilie, die Mal-vee'-na shtant mit ee'-rem fah'-ter fore i'-ner lee'-li-ai, dee unter einem Rosenstrauch blühte. Blenbent weiß, wie ein zōn'-ter i'-nem ro'-zen-shtauch blü'-hai-tai. Blen'-dent vice, vee ine Lichtstraß, erhob die schöne Blume ihren offenen tusten-lyt'-shtrahl, err-hope'-dee sho'-nai bloo'-mai ee'-ren of'-nen dōst'-tenben Relch. Ueber ihr hing eine voll aufgeblühte kräftige den kely. u'-ber eer hink i'-nai fōl ouf'-gai-blü'-tai kref'-ti-gai Rose, und warf einen rōthlichen Schimmer auf die garten ro'-zai, zōnt varrt i'-nen rōt'-ly'-yen shim'-mer ouf dee tsahr'-ten Silberblätter der Lilie, und so floß auch beider Blumen-zit'-her-blet'-ter dair lee'-li-ai, zōnt zo flōss ouf bi'-der bloo'-men-tust in rinanter. dōst in ine-an'-der.

O, welch ein schöner Bund! rief Malvina, und neigte Oh, vely ine sho'-ner bōnt! reef Mal-vee'-na, zōnt ni'-y-tai

Kindelnd ihr Haupt zu den Blumen hinab. ley'-yehnt eer haupt tsoo dain bloo'-men hin-ap'.

Es ist der Bund der Unschuld und Liebe! ermieterde Ess ist dair bōnt dair zōn'-shōlt zōnt lee'-bai! err-vee'-der-tai der Vater. So stanten sie schweigen vor den Blumen. dair fah'-ter. Zo shtan-den zee shvi'-ghent fore dain bloo'-men.

Indes trat Ossar in den Garten, Malvina's stiller In-dess trahit Oss-karr in dain garr'-ten, Mal-vee'-nass shtil'-ley Gliechter. Da floß ein rōthlicher Hauch über Malvina's gai-leep'-ter. Dah flōss ine rōt'-ly'-yer houch u'-ber Mal-vee'-nass Wangen, wie ter Rose Glanz über die Lilie. vang'-en, vee dair ro'-zai glants u'-ber dee lee'-li-ai.

Da sah der Vater sie an und sprach: Nicht wahr, Malvina. Dah zah dair fah'-ter zee an zōnt shprach: Nyt wahr, Mal-vee'-na, die Blumen haben eine Errache und ein Kuss? dee bloo'-men hah'-ben i'-nai shprah'-gai zōnt ine ant'-lits? Für die Unschuld und Liebe! sagte Ossar hingu. Fu'r dee zōn'-shōlt zōnt lee'-bai! zets-tai Oss-karr hin-tsoo'.

VOCABULARY.

lilie, f. lily.	Schimmer, m. glimmer.	tig, guilty, in-
Strauch, m. bush.	Silber, n. silver.	debted.) [time.
Blenden, to dazzle.	Duft, m. odour.	Indes, in the mean-
Strahl, m. beam.	Welch, -tr, -st, which,	Gefichte, m. and f. be-
Duften, to spread	what.	loved, love.
odour.	Bund, m. alliance.	Hauch, m. breath.
Relch, m. cup, calix.	Neigen, to incline.	Glanz, m. resplen-
Aufblühen, to blow, to	Sinab, down.	dence, splendour.
open.	Unschuld, f. innocence.	Errache, f. language.
Kraftig, strong. (Kraft,	Schuld, f. guilt,	Singstehen, to add.
f. strength.)	debt, fault; (Schul-	(Sagen, to put.)

11.—Die Kage, die alte und die junge Maus.
Dee kat'-tsai, dee al'-tai zōnt dee jōng'-ai mouse.

Die Kage.
Dee kat'-tsai.

Du allerliebste! Meines Thier.
Doo al'-ler-leep'-stess kli'-ness teer,
Komm doch ein wenig her zu mir,
Komm doch-ine vey'-ny' heyr tsoo meer,
Ich bin dir gar zu gut; komm doch ich dich nur küsse.
Iy bin deer gahr tsoo goo't; kōm dass iy diy noor küss'-sai.

Die alte Maus.
Dee al'-tai mouse.

Ich rathe dir, Kind, gehe nicht!
Iy rah'-tai deer, kint, ghey'-hai nyt!

Die Kage.
Dee kat'-tsai.

So komm doch; siehe, tiefe Nüsse
Zo kōm dōch; zee'-hai, dee'-zai nūss'-sai
Sind alle rein, wenn ich dich einmal küsse.
Zint al'-lai dine, ven iy diy ine-mahl küss'-sai.

Die junge Maus.
Dee jōng'-ai mouse.

O Mutter, höre doch, wie sie so freundlich spricht.
O mōst'-ter, hō'-rai dōch; vee zee zo freunt'-ly shpri't.
Ich geh.
Iy ghey.

Die alte Maus.
Dee al'-tai mouse.

Kind, gehe nicht!
Kint, ghey'-hai nyt!

Die Kage.
Dee kat'-tsai.

Nach dieses Zuckers und andre kleine Sachen
ouch des'-zess tsōk'-ker-brote zōnt an'-dral sho'-nai zach'-chen
Ich geh, wenn du kommst.
gub' iy deer, ven doo kōmst.

Die junge Maus.
Dee jōng'-ai mouse.

Was soll ich machen?
Vass soll iy mach'-chen?
O Mutter, laß mich gehn!
O mōst'-ter, lass mi'y gheynt!

Die alte Maus.
Dee al'-tai mouse.

Kind, folg' mir, gehe nicht!
Kint, fōl' meer, ghey'-hai nyt!

Die junge Maus.
Dee jōng'-ai mouse.

Was wird sie mit denn thun? welch christliches Gesicht!
Vass virrt zee meer den toon? vely eyr'-ly'-yess gai-zlyt!

Die Kage.
Dee kat'-tsai.

Komm, Meines Märchen, komm!
Kōm, kli'-ness mer'-yen, kōm!

Die junge Maus.
Dee jōng'-ai mouse.

Ach, Mutter, hilf! O weh!
ach, mōst'-ter, hilf! Oh vey!
Sie mürge mich! Ach, die Gans! Sie!
Zee mürge mi'y! ach, dee garr'-sti-gail!

Die alte Maus.
Dee al'-tai mouse.

Nun ist's zu spät, nun ist das Unglück schon betroffen.
Noun ist's tsoo shpeyt, noun dy dass zōn'-gluck sho'-ne bai-trōf'-fen.
Wer sich nicht raten läßt, hat Hilfe nicht zu hoffen.
Veyr ziy nyt rah'-ten lest, hat hul'-fai nyt tsoo hōf'-fen.

VOCABULARY.

Kage, f. cat.	like do in do come,	Würgen, to choke,
Maus, f. mouse.	pray.)	throttle.
Gut sein, to be fond	Dich, thee.	Gefähr, ugly, horrid.
of.	Sein, thine.	Spät, late.
Gut, entirely.	Sache, f. thing.	Glad, n. fortune, luck.
Zu, too.	Ehrlich, honest, -ly.	Schon, already.
Rathen, to advise.	(Gehr, f. honour.)	Betreffen, to befall.
Dir (dative), to thee.	Gesicht, n. face.	(Treffen, to hit,
Komm doch, do come.	Narr, m. fool.	meet.)
(Doch, emphatic.)	Helfen, to help.	Hilfe, f. help.

KEY TO EXERCISES IN LESSONS IN GERMAN.

EXERCISE 128 (Vol. II., page 341).

1. Did you see this neat little garden? 2. No, for I admired that pretty cottage. 3. It belongs to two old people, whom I know. 4. What kind of pretty little animals are those? 5. There are a great many young lamkins in the garden. 6. This girl plays with her little brother. 7. Will you give me that little chest? 8. Will you have that one on the little table? 9. Look, what a neat little hat. 10. The little child is delighted with his little kitten and with his gosling. 11. So arrange it that you may be at my house by Saturday morning. 12. Do we make it in such a manner that it is useful for both purposes? 13. He shall so arrange it that he can take his books with him. 14. At all events, I will so arrange it that I shall be with you at ten o'clock. 15. We will so arrange it that we by no means come too late. 16. Tell your brother he should so arrange it that it may be understood by everybody. 17. I hope you will so arrange it that you will arrive by the last steamboat. 18. A prophet is nowhere less esteemed than in his native country and in his house. 19. His voice has great influence in the council. 20. What will you bet that in twenty years the greater part of Europe is republican? 21. The inclination to vice is much stronger in us than to virtue. 22. The recognition of our performances is a powerful impulse to industry. 23. The business of his manufactories increases from year to year. 24. He lifted up his eyes. 25. He jumped for joy, and clapped his hands. 26. The children were jumping up.

LESSONS IN ARCHITECTURE.—XVI.

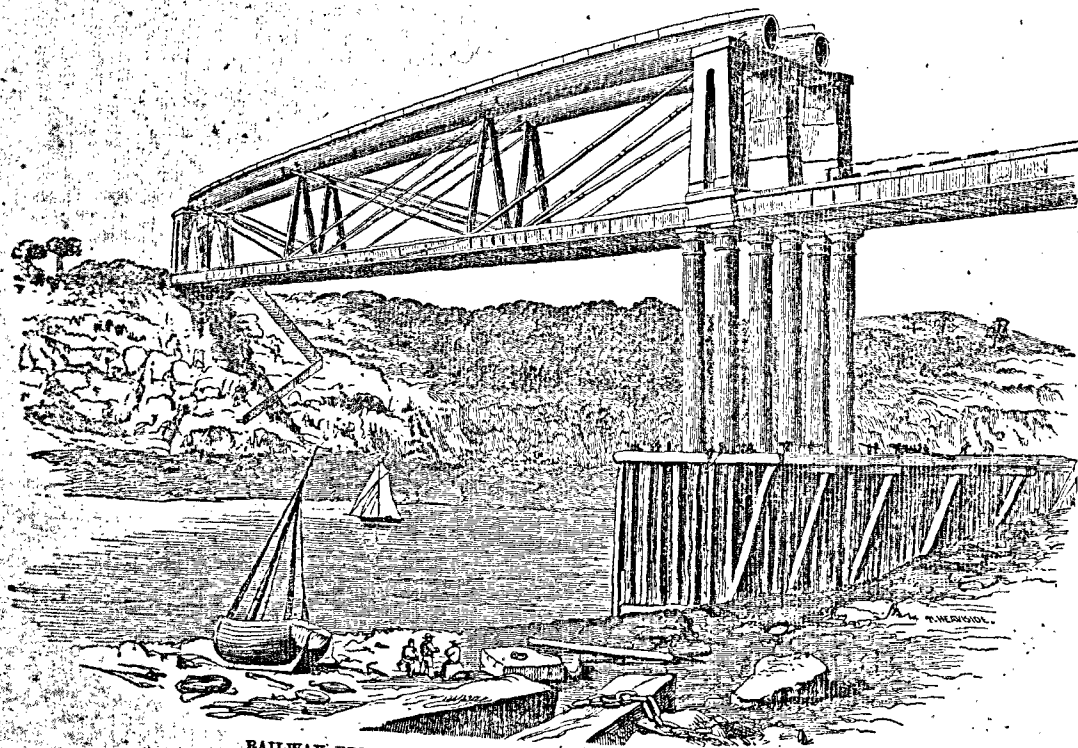
RAILWAY ARCHITECTURE.—II.

THE necessity that railways should frequently be thrown across rivers and streams has given rise to the highest displays of constructive skill in railway architecture. The bridges formed for this purpose present an infinite variety of detail, but the most important may be classified as suspension, tubular, and lattice bridges, in all of which iron is the principal material employed. Brickwork and masonry, except in the piers and abutments, are unsuited to bear the violent strain produced by railway traffic. To construct a substantial railway bridge of such material over a stream of more than the smallest proportions, the piers would have to be so closely set together as seriously to impede the navigation. This difficulty was removed by the use of iron girders or beams of various forms, which we shall presently describe; and by these means it was found possible to give a very wide span to the arches, with perfect safety to the bridge. Iron arches were employed for bridges before the introduction of railways—for example, in the very fine bridge over the Thames at Southwark, which was completed in 1819. In their adaptation to railway architecture, cast-iron was the material at first employed, but this was known to be unsafe for arches of any considerable span. Cast-iron was well enough calculated to act as a support for the traffic, but unfitted to sustain the thrust and vibration produced by the passage of trains over an arch or span of large dimensions. A method of trussing the cast-iron girders with wrought-iron bars was then introduced, the tensile power of the wrought-iron partly removing the defect produced by the rigidity of the other material. But the failure of one of these trussed girder bridges, with spans of nearly 100 feet, on the Chester and Holyhead Railway, in 1847, shook the faith of engineers in the principle, and the use of wrought-iron alone then became general.

To return to our classification of iron railway bridges, we have first to mention the suspension bridge. Structures of this kind are usually built in the following manner. A massive tower of masonry is erected on each side of the stream, these towers being termed the *abutments*. Over the tops of the towers are passed chains formed of bars of iron, the ends of which chains are sunk to a great depth in the ground, and firmly embedded therein. From these chains iron rods are hung, to support the roadway which passes from tower to tower. Among the good examples of ordinary suspension bridges may be mentioned that at Hammersmith, on the Thames; Hungerford Bridge, afterwards removed to Clifton; and the bridge of this kind across the Menai Straits.

In the earlier days of railway construction, this form of bridge was not considered suitable for railway traffic. The passage of a train over such a bridge would depress the chain and roadway at either end, raising it at the centre, and so

This is a form peculiar to railway architecture, the great engineer who designed the first having before him no previous structure similar in kind—although applied to other purposes, as in the case of the suspension bridges—to suggest the idea and guide him in carrying it out. The first tubular bridge was that thrown by Mr. Robert Stephenson across the Menai Strait, not far from the suspension bridge to which we have before alluded. It was a necessary condition, imposed by the Admiralty, that the central arches of a bridge across this strait should be of more than 400 feet span, and 100 feet above the surface of the water at the highest tide, to preserve the freedom of the navigation. In studying the problem of how to accomplish this end with the utmost security, Mr. Stephenson determined, after repeated experiments, to adopt a tubular form for his girders, and to make his bridge, so to speak, a tunnel suspended in the air. A further series of experiments convinced him that a rectangular tube was the most suitable for the purpose, possessing far greater



RAILWAY BRIDGE AT CHEPSTOW.—PROCESS OF CONSTRUCTION.

endanger the security of the entire fabric. But this tendency was counteracted by various devices to stiffen the roadway; and a great engineering triumph was achieved when, in 1848, a railway suspension bridge, spanning a chasm of 800 feet, was built over the Niagara river below the falls. In this bridge wire cables are made to support a rectangular tube, which carries both an upper and a lower roadway, the former for the railway traffic, and the lower for that of vehicles and foot passengers. A representation of this very remarkable structure is given in one of our engravings.

Another kind of suspension bridge is occasionally employed for railway purposes. In this form the roadway is supported by chains and rods which hang from wrought-iron tubes, these tubes passing from tower to tower or from pier to pier, instead of the chains before mentioned. The great railway bridges at Chepstow and Saltash are formed in this manner. The method of their construction will be understood by a reference to our illustration of the first-named example, on the South Wales Railway.

We come now to the second classification of iron railway bridges—namely, those constructed on the tubular principle.

strength than tubes either cylindrical or elliptical in form. His idea, as finally resolved on and carried out, was, therefore, that of a long tube, in section an oblong square, made of plates of cast-iron closely riveted together, the chief weight and supporting power of the material being massed in a cellular form at the top and bottom of the structure. Two million rivets were employed throughout the tube. These rivets, when brought to the works, were formed with only one end flattened, holes being punched in the plates to receive them. Each rivet, before being fixed in position, was made red-hot in a furnace, then taken up by pincers and inserted in its place, when the unflattened end of the hot metal was hammered on the inside until another head was formed, and the plates were thus securely bound together.

The Britannia Tubular Bridge, when completed, consisted of four spans over the Strait, the two central spans 460 feet each in length, and the two at the sides half those dimensions. A representation of this structure is given in our illustrations. An immense bridge of the same character was afterwards erected across the St. Lawrence at Montreal. It consists of a tube more than 6,500 feet long, divided into twenty-five spans, the

central one of 330 feet; but the masonry of the piers is of much greater strength and proportion than in the case of the Britannia Bridge, to resist the force of the great masses of ice which in winter are brought down the stream.

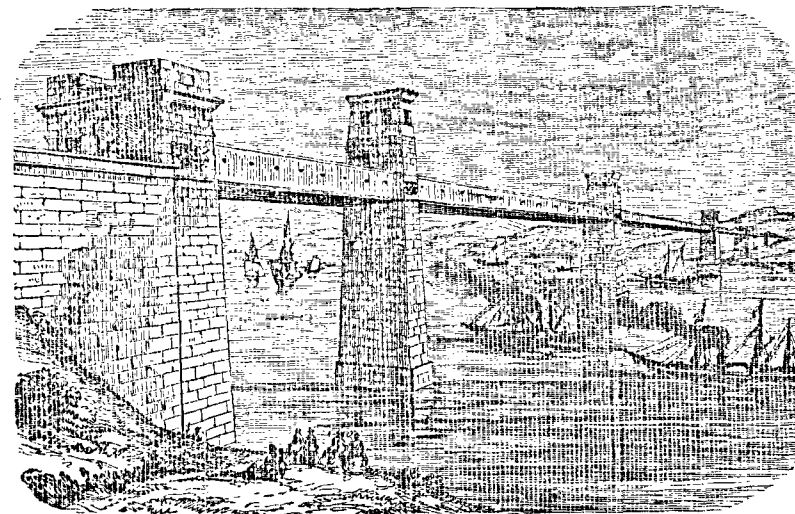
The Britannia Bridge was justly considered, at the time of its construction, a great engineering triumph; but, brilliant as was the idea, a great improvement has since been made upon it. This improvement consists in the substitution of *lattice girders* for those of a tubular form. In the tubular girders the sides are formed of solid plates. In the lattice girders, as the name implies, the sides are composed of a kind of open lattice-work formed of bars or rods of iron, which cross each other diagonally. By this means, in the first place, a great saving is effected in the material employed; next, every portion of that material can

A good example of the lattice-girder bridge is seen in that of the London, Chatham, and Dover Railway over the Thames at Blackfriars, the girders in this case resting on columns of iron,

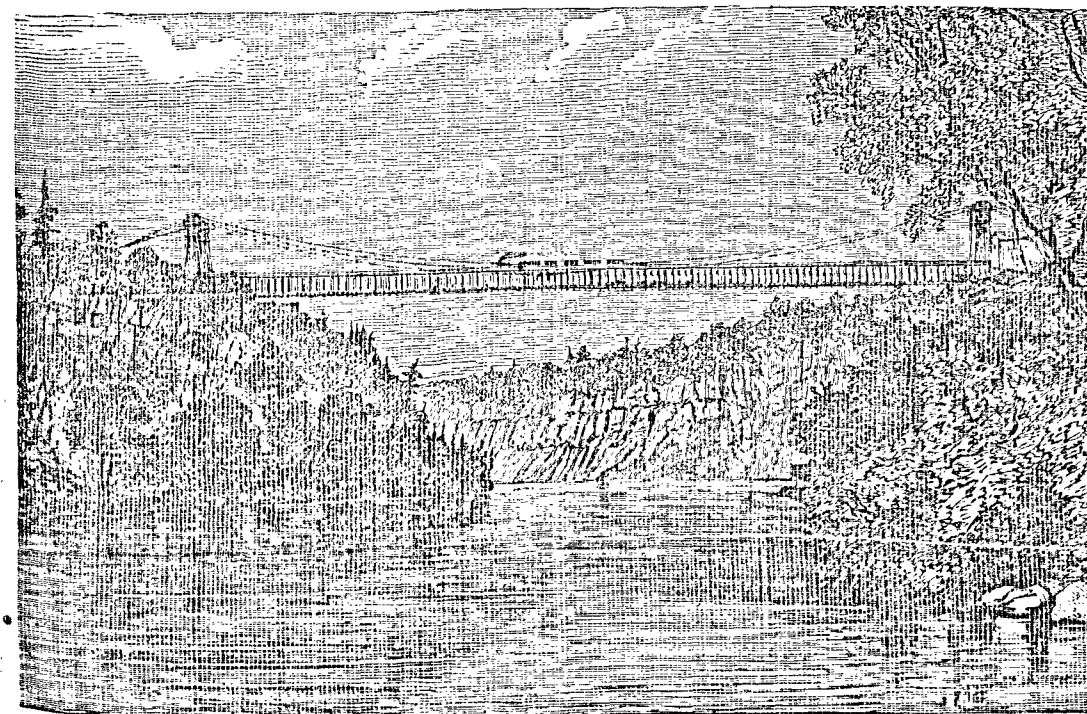
which are set on stone foundations. Railway bridges of recent construction are almost all of this form. The riveting is carried out on the same principle and to the same extent as in the case of the Britannia Bridge, and the same amount of strength which is there afforded by the cellular arrangement of material above and below, is given in the lattice bridges by iron-beams which, at frequent intervals, cross the principal girders, both at top and bottom, at right angles.

The use of iron girders has greatly

facilitated the construction of what are known as *skew bridges*, i.e., bridges the line of which runs askew or obliquely to that of the stream. The peculiar formation which it was



BRITANNIA TUBULAR BRIDGE ACROSS THE MENAI STRAIT.



BRIDGE ACROSS THE NIAGARA RIVER, BELOW THE FALLS.

be so adjusted as to bear a full share of the strain of the traffic; and lastly, the whole fabric presents a smaller surface to the action of the wind and weather, while at the same time it can be more easily repainted or repaired.

necessary to give to the component parts of the arches in stone bridges, on the skew principle, rendered these difficult of construction, and they were comparatively unsafe for the enormous strain of general railway traffic.

LESSONS IN BOOKKEEPING.—XXIII. DAY BOOK.

(3)

(3)

August 21st.				Dr.				Cr.			
				£	s.	d.		£	s.	d.	
Brought forward				4488	1	0		4488	1	0	
J. Roberts Dr. to Sundries								2503	2	0	
For Amount of Invoice of Plantation Stores, etc., per the Rain-bow for Jamaica, as per Invoice Book, fol. 2:											
To Export Goods				1544	4	0					
To Adventure in Scotch Linen				803	6	0					
To Charges (for Duties and Fees £2 12s. 6d., Freight £18 7s. 6d.)				21	0	0					
To Commission (2½ per cent. on Goods and Charges)				59	7	0					
To Insurance (Premium on £2,550 and Policy)				57	10	0					
To Commission (½ per cent. on do.)				12	15	0					
				£ 6991	3	0		£ 6991	3	0	
September 9th.											
Dawson & Hancock Dr. to Adventure in Scotch Linen				1750	0	0		1750	0	0	
Sold 8 Cases of Scotch Linen				£ 1750	0	0		£ 1750	0	0	
October 8th.											
W. Knight & Co. Dr. to Import Goods								234	0	0	
For 7 hhds. of Sugar, per the Ballarat, Net 78 cwt., at 60s. per cwt.				234	0	0		2	6	9	
Brokerage Dr. to W. Knight & Co.											
For their Brokerage on £234, at 1 per cent.				2	6	9					
20th.											
W. Knight & Co. Dr. to Import Goods								458	5	2	
For 14 Tierces of Coffee, per the Wellington, Net 76 cwt. 22 lbs., at 12s. 6d. per cwt.				462	17	9					
Discount, 1 per cent.								4	12	7	
22nd.											
W. Knight & Co. Dr. to Import Goods								218	0	4	
For 6 Tierces of Coffee, per the Wellington, Net 32 cwt. 1 qr. 18 lbs., at 120s. per cwt.				194	9	4					
1 Tierce, Net 4 cwt. 1 qr. 17 lbs., at 117s. per cwt.				25	15	0					
Discount, 1 per cent.								2	4	0	
22nd.											
Brokerage Dr. to W. Knight & Co.								6	16	7	
For their Brokerage on £683 2s. 1d., at 1 per cent.				6	16	7		£ 926	5	5	

(4)

DAY BOOK.

(4)

November 24th.				Dr.				Cr.			
				£	s.	d.		£	s.	d.	
Import Goods Dr. to Sundries								234	0	0	
For Amount of Sales of Sugar, per the Ballarat, as per Account Sales Book, fol. 1:											
To Insurance (for Premium and Policy on £175 and Com. on do.)				6	13	0					
To Brokerage (per W. Knight & Co.)				2	6	9					
To Charges (Freight £23 15s. 4d., Duties and Fees £107 8s. 7d., Dock Dues, etc., £5 19s. 6d.)				137	3	5					
To Commission (2 per cent. on £234)				4	13	4					
To N. Herschell, for Net Proceeds				83	3	6					
30th.											
Import Goods Dr. to Sundries								676	5	6	
For Amount of Sales of Coffee, per the Wellington, as per Account Sales Book, fol. 2:											
To Insurance (for Premium and Policy on £700 and Com. on do.)				22	16	9					
To Brokerage (per W. Knight & Co.)				6	16	7					
To Charges (Freight £42 15s., Duties and Fees £3 4s. 6d., Dock Dues, etc., £12 11s. 1d., Public Sale Charges £1 7s. 6d.)				59	18	1					
To Commission (2½ per cent. on £676)				16	18	0					
To J. Henderson, for Net Proceeds				569	16	1					
Insurance Dr. to Sundries*								29	9	9	
To N. Herschell				6	13	0					
To J. Henderson				22	16	9					
				£ 939	15	3		£ 939	15	3	
December 31st.											
Interest Dr. to Schofield, Halse, & Co.								18	10	0	
For Interest due to them, less postage, as per Account Current Book, fol. 1				18	10	0		18	10	0	

* This entry is rendered necessary because both the parties whose names appear were debited with the Insurance in July, and they are again charged for the same in the account of the sales in the preceding entries. They must, however, be only once charged in the Ledger, and this entry effects the required purpose.

INTEREST ACCOUNT WITH THE UNION BANK. FROM JULY 1 TO DECEMBER 20, 1881.

Dates.	Drafts.	Deposits.	Balances.	Days.	Products.
July 1			2550	5	12750
" 6		175	2725	6	16350
" 12	1146		1579	6	9474
" 18		1200	2779	11	30569
" 29	10		2769	4	11076
Aug. 2	321		2448	2	4896
" 4		970	3418	25	85450
" 29		116	3534	1	3534
" 30	39		3495	1	3495
" 31	15		3480	1	3480
Sept. 1		153	3633	1	3633
" 2	13		3620	3	10860
" 5	19		3601	3	10803
" 8		725	4326	4	17304
" 12	268		4058	0	
" 13		12	4070	3	12210
" 15	1016		3054	0	
" 17	905		3104	2	6208
" 20		500	2199	3	6597
" 21		2847	2699	1	2699
" 23	24		5546	2	11092
" 25	108		5522	2	11044
" 27		1513	5414	2	10828
" 29	240		6927	2	13854
" 30		12	6687	0	
Oct. 1	15		6699	1	6699
" 3	6		6684	1	6684
" 4	541		6678	1	6678
" 8		26	6137	0	
" 10	43		6163	2	12326
" 11		1175	7338	4	29352
" 12		580	7918	2	15836
" 14			7875	1	7875
" 15		1000	8875	1	8875
" 16			8870	2	17740
" 17			8859	1	8859
" 18		250	9109	6	54654
" 19		290	9399	1	9399
" 20			9325	1	9325
" 21	74		9325	1	9325
" 22		1839	11164	6	66934
" 23			11144	6	66864
" 24	20		10844	3	32532
Nov. 4	300		11444	1	11444
" 7		600	11676	1	11676
" 8		232	13286	1	13286
" 9		1610	14163	2	28326
" 10		877	12282	2	24564
" 12	1881		15159	2	30318
" 14		2877	15099	1	15099
" 16	60		17509	1	17509
" 17		2500	17466	1	17466
" 18	133		17066	3	51198
" 19	400		17735	1	17735
" 22		660	18335	1	18335
" 23		600	18470	6	110820
" 24		135	18460	1	18460
" 30	10		18676	1	18676
Dec. 1		216	20426	1	20426
" 2		1750	20608	1	20608
" 3		182	21335	5	106675
" 4		727	21495	1	21495
" 9		160	21795	5	108975
" 10		300	22295	4	89180
" 15		500	21995	2	43990
" 19	300		22345	3	67035
" 21		350	22228	2	44456
" 24	117		22771	1	22771
" 26		543	22739	1	22739
" 27	32		23178	2	46356
" 28		439	23158	1	23158
" 30	20				

The following is the method that must be followed in calculating the interest on the products:—

1) 1701754	£233 : 2 : 10
10) 567251	5½ off
10) 56725	
5673	2) 233 : 2 : 4½
2331403, or £233 : 2 : 10	£116 : 11 : 2 interest.

HISTORIC SKETCHES.—XXXIV. COUNCILS.

THERE have been twenty General Councils of the Church besides that which the late Bishop of Rome summoned to meet in 1869. The first met in the year of our Lord 325; the twentieth in 1545. Many have been the motives why they assembled, far reaching and important have been the results of their deliberations. The first, over which the Emperor Constantine presided, decreed the consubstantiality of the Son of God, condemned the Arian heresy, which denied the divinity of Christ, and composed the Nicene Creed; the last, the Council of Trent, lasted eighteen years, and settled many points of doctrine as necessary to salvation. It decided with anathemas what books of the Holy Scripture were to be received as canonical, and decreed that the Church was the sole interpreter of Scripture. What traditions of the Church were to be received as equal in authority to the Scriptures were also marked out; the rites of baptism, confirmation, holy communion, penance, extreme unction, orders, and matrimony, were established as sacraments; and the doctrines connected with transubstantiation, purgatory, indulgences, celibacy of the clergy, and auricular confession were authoritatively laid down.

With the points thus settled, the Church was satisfied, or appeared to be so, until the year 1868, when the Papal Court thought fit to summon an assembly of bishops to decide the various questions which had been mooted among Roman Catholics for many years past. The councils so assembled were called Ecumenical or General Councils, and their decrees were of universal application; but there were besides smaller assemblies for the judgment of local disputes in the Church, and presided over by the archbishop or bishop of the province. These assemblies were called Provincial Councils or Synods; their decrees were binding only upon the ecclesiastical subjects of the province, and were, of course, liable to reversion upon appeal to a general council of the whole Church. They met in the spring and autumn of each year, upon the summons of the archbishop of the province, and settled all points both of faith and discipline. The primates of Rome, Alexandria, Antioch, Carthage, and afterwards Constantinople, exercised this sway over their dioceses, and their example was afterwards followed by the archbishops who were their suffragans. But the general councils—councils like that which sat in Rome a few years ago—were summoned only by the emperor himself. "Whenever the emergencies of the Church required this decisive measure, he dispatched a peremptory summons to the bishops or the deputies of each province, with an order for the use of post-horses, and a competent allowance for the expenses of their journey." The fathers assembled, and the emperor was wont, while nominally presiding, to content himself with a lowly place in the midst of the assembly, and to leave the deliberations of the council free, even to the extent of frequently not attending at all. A belief sprang up, founded upon the assurances made by our Lord to the apostles, and upon what may be termed the probabilities of the case, to the effect that so liberal an effusion of the Holy Ghost was made upon the members of the council, that collectively they were infallible, and, therefore, that their decrees were to be received as the utterances and commands of God himself. This idea of infallibility was carried to its extreme point upon more than one occasion, the pope himself being made not only subject to the council, but in one memorable instance, that of John XXIII., actually deposed by it. The popes were, of course, at all times anxious to be saved from such friends, and were ever on the watch to play them some evil turn which should reduce them to the position in which the fathers of the council of 1869-70 stood to the Pope—a position of dependence and utter subjection. The councils, however, were equally on the alert to countermine any such attempts; and when Pope Eugenius IV., in 1431, tried to assume control over the

Council of Basle, and the right to dissolve it, the members took the sharpest of means with him, and anticipated his bull by a decree, in which they affirmed that the representatives of the Church militant on earth were invested with a divine and spiritual jurisdiction over all Christians, without excepting the Pope; and that a general council could not be dissolved, prorogued, or transferred, except on its own free deliberation and consent. Following up this boldness of speech by boldness of action, they gave the Pope sixty days to repent of his folly, promising, unless he withdrew his offensive pretensions, they would suspend him from the exercise of his spiritual and temporal functions. Eugenius recanted, and with his own hand rescinded the bull he intended to fulminate against the council. Gradually, with the patience which belongs to an institution that considers itself eternal, the Roman churchmen arrogated to themselves a power over the lay prince who was their constitutional head, and went so far at the Council of Lyons, held in 1245, under the presidency of Innocent IV., as to depose the Emperor Frederick on account of the firm stand he had made against ecclesiastical usurpation and the claim of the so-called saints to judge the world, as represented by kings obnoxious to the Church's interests. And so it came about that, whereas the emperors alone had in former times the right to summon a council, councils became perfectly independent of the emperor, and could and did act upon their own authority, to the complete exclusion of the lay element.

A glance at the following list will show the number, date, and occasion of the great councils which have been held. Those numbered in Roman letters are the general or oecumenical councils; but the others are of importance enough, though only provincial synods, to merit a place in the list:—

- | | |
|--|----------|
| I. FIRST OECUMENICAL OR GENERAL COUNCIL, held at Nice, in Bithynia. Constantine the Great presided . . . | A.D. 325 |
| At Tyre, against Athanasius of Alexandria . . . | 335 |
| At Constantinople, when the Arian heresy gained ground at Rome, in favour of Athanasius . . . | 337 |
| At Sardis, attended by 370 bishops. The Arians condemned . . . | 342 |
| At Rimini, attended by 400 bishops. A new confession of faith drawn up . . . | 347 |
| II. CONSTANTINOPLE . . . | 359 |
| III. EPHESUS.—Pelagius censured. Pelagius was an Englishman, who taught that physical death was not a consequence of Adam's fall, but would have happened in any case; that the consequences of Adam's sin were confined to himself; that new-born infants are as Adam was before the fall; that the law qualified men for heaven as well as the Gospel; and that the general resurrection did not follow because of Christ's resurrection from the dead . . . | 381 |
| IV. CHALCEDON.—Eutychianism censured. Eutyches, an abbot, taught the creed (professed this day by Copts and Armenians) that there was but one nature in Christ, the human having been absorbed in the divine . . . | 451 |
| V. CONSTANTINOPLE.—Origen's teaching condemned. Origen, who lived in 185-253, taught that Christ was the Son of God only by adoption and grace; that souls were created before the bodies; that the planets and stars had souls; that the punishment of the damned was not eternal; and that the fallen angels would one day be restored . . . | 451 |
| VI. CONSTANTINOPLE, against the Monothelites, or Eutychians . . . | 553 |
| VII. SECOND NICENE COUNCIL, against Iconoclasts, or breakers of images in churches, the Church having been violently sundered by the question whether it was lawful or not to use images in the churches . . . | 681 |
| VIII. CONSTANTINOPLE, against Iconoclasts . . . | 787 |
| The Council of Clermont, attended by 310 bishops, authorised the crusades . . . | 870 |
| IX. FIRST LATERAN.—The right of investiture, or presentation to ecclesiastical benefices, which had been claimed both by pope and emperor, and had been the subject of bitter wars, and was yet to be so, arranged for a time by treaty between Pope Calixtus II. and the Emperor Henry V. . . . | 1095 |
| X. SECOND LATERAN.—Innocent II. presided. The chief subject of discussion was how most effectually to preserve the temporalities of churchmen . . . | 1123 |
| XI. THIRD LATERAN.—Schismatics condemned . . . | 1139 |
| XII. FOURTH LATERAN.—Innocent III. presided, and authorised the crusade against the Albigenses. Doctrine of transubstantiation promulgated . . . | 1179 |

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| XIII. LYONS, under Innocent IV.—Deposed the Emperor Frederic, on the ground that the saints being commissioned to judge the world, kings were not exempted, and that it behoved the Church to punish offenders against her, without respect of persons . . . | 1245 |
| XIV. LYONS.—A temporary union effected between the Greek and Latin Churches . . . | 1274 |
| XV. VIENNE IN DAUPHINÉ.—Clement V. presided. The Order of the Knights Templars suppressed . . . | 1312 |
| XVI. PISA.—Of the three claimants of the Papal throne, Gregory XII. and Benedict called XIII., who held his court at Avignon, deposed, and Alexander V. elected . . . | 1409 |
| XVII. CONSTANCE.—Martin V. elected pope in place of John XXIII., deposed. John Huss and Jerome of Prague condemned for heresy, and burned . . . | 1418 |
| XVIII. BASLE.—Eugenius IV. deposed from the papacy, and Amadeus of Savoy chosen . . . | 1443 |
| XIX. FIFTH LATERAN, against the pragmatic sanction of the French kings, asserting the rights of the Gallican Church as against the Pope . . . | 1512 |
| XX. TRENT.—Sat for eighteen years, and condemned, amongst other things already mentioned, the doctrines of Luther, Calvin, and Zwingle . . . | 1545-1563 |

Such are the principal councils held by the Roman Church till the last meeting of the council of the Vatican, of which the main object seems to have been to obviate the necessity of calling councils in future, by declaring transferred to the Pope, as head of the Church, that quality of infallibility hitherto supposed to be a peculiar attribute of councils only. This notion of infallibility, residing somewhere in the body of the Church militant, was first formulated into an article of faith, by the great architect of the Roman Church power, Hildebrand (Gregory VII.). It had been mooted before, but never established as an essential part of the creed. Until long immunity from the persecution and adversity in which the Church of Christ had first grew and flourished, had made the Christian clergy seekers after new things, and aspire to kingdoms which are of this world, the Church was content to leave alone such awful questions as those which now are spoken trippingly by the tongues of courtiers in the palace of him who in effect sits in the temple of God, saying, "I am God." The rise and spread of differences in opinion, the schisms which, as will be seen in reference to the above list, separated into distinct and even antagonistic churches, large bodies of those who had formerly "lived together in unity," seemed to call for some authority which should decide all differences, that authority being guided in its decisions by an unerring instinct directing it unconsciously to an absolutely truthful conclusion. Such an authority, it was thought, must be indwelling in the body of the Church with which Christ had promised to be always, even unto the end of the world; in the Church that was built upon the rock against which the gates of hell shall not prevail.

Once established that such an authority was necessary, it was easy to find a place where it might be supposed to dwell. Start with the belief that truth is not many-sided, that absolute truth can be found, and that one telescope only can reveal it—all other telescopes, no matter by whom made, being bad and deceptive—and you are driven to seek some infallible oracle such as that now demanded at Rome. The transfer of the attribute from council to pope is simply a matter of convenience, and is really no more startling in itself than the original claim of councils to be infallible. But it has taken the Roman Church several centuries to arrive at the ultimate consequence of the claim on the part of any human being, or body of human beings, to be infallible. It was Gregory VII. who first proclaimed the infallibility of the Church. Before his time, Christians were content to meet in council for the purpose of discussion, and of agreeing, without intolerance of others who could not but think differently, upon questions on which it seemed desirable to have a common faith. They did not declare all men eternally lost who had different degrees or different kinds of light. Uniformity, however, was necessary to the ideal of Christianity which Hildebrand and his advisers formed in their own minds; to secure uniformity it was necessary to proclaim infallibility; and infallibility was accordingly asserted to dwell in the Church of Rome—not of Christ, be it observed—which "has been, is, and will continue, infallible."

The effect of this decree has been to justify, as the direct inspiration of God himself, some of the most blasphemous, some

of the most inhuman—to say nothing of undivine—acts that it was possible for sinful men to be guilty of. The inordinate craving after power, temporal as well as spiritual, which has distinguished the papacy since Hildebrand's time, and which has proved to be the great source of its weakness, was fostered and encouraged by the doctrine. Religious wars—save the mark—religious hatreds, malice and all uncharitableness, bloodshed, and dismal delay in the education of the world, have all arisen out of the evil assumption by men of an attribute which our blessed Lord, tempted to assume dominion over all the kingdoms of the world, and the glory of them, steadfastly renounced. The power hitherto supposed to be inherent in councils is now to be transferred to the Pope. An infallible Church is represented by a general council, which is therefore itself infallible; and being so, is able, without the slightest shock to any historic sentiment, to depose itself in favour of one infallibly elected to receive its functions. Such was the scene which was enacted at Rome at the last council, a scene which appropriately comes after the scenes formerly enacted there, in which dissentients were burned, the consciences of men were bound up tightly in bonds from which they have never since been free, and in which truly men have "played such fantastic tricks before high heaven as made the angels weep."

LESSONS IN FRENCH.—XLVII.

SECTION CIII.—ABBREVIATIONS.

The following is a list of the most usual abbreviations employed in French:—

ABBREVIATIONS.	MEANINGS.
A. P. A protester.	To be protested.
A. S. P. Accepté sous protêt.	Accepted under protest.
A. S. P. C. Accepté sous protêt pour compte.	Accepted under protest on account.
Bar. Baron.	Baron.
Che. Chevalier.	Chevalier, knight, sir.
Com. Comte.	Count.
Comtesse. Comtesse.	Countess.
Dr. Docteur.	Doctor.
Dr. M. D. Docteur-médecin.	Doctor of medicine.
E. Est.	East.
J.-C. Jésus-Christ.	Jesus Christ.
LL. AA. LL. Leurs Altesses Impériales.	Their Imperial Highnesses.
LL. AA. RR. Leurs Altesses Royales.	Their Royal Highnesses.
LL. AA. SS. Leurs Altesses Sérénissimes.	Their Most Serene Highnesses.
LL. Em. Leurs Eminences.	Their Eminences.
LL. Ex. Leurs Excellences.	Their Excellencies.
LL. HH. Leurs Hautesse.	Their Highnesses.
LL. MM. Leurs Majestés.	Their Majesties.
LL. MM. LL. Leurs Majestés Impériales.	Their Imperial Majesties.
LL. MM. RR. Leurs Majestés Royales.	Their Royal Majesties.
M. ou Mr. Monsieur.	Sir, Mr.
M. A. Maison assurée.	House insured.
M. A. C. I. Maison assurée contre l'incendie.	House insured against fire.
M. Marchand.	Dealer, shopkeeper, m.
Mde. Marchande.	Dealer, shopkeeper, f.
Msr. Monseigneur.	My lord.
Mis. Marquis.	Marquis.
Misc. Marquise.	Marchioness.
Mlle. Mademoiselle.	Miss.
MM. Messieurs.	Messrs., Gentlemen.
Mme. Madame.	Madam, Mrs.
Mst. Manuscrit.	Manuscript.
Mtre. Maître.	Master.
N. B. Nota bene.	Nota Bene.
N.-D. Notre-Dame.	Our Lady.
N.-N.-E. Nord-nord-est.	North-north-east.
N.-N.-O. Nord-nord-ouest.	North-north-west.
No. Numéro.	Number.
N.-S. Notre-Seigneur.	Our Lord.
N.-S. J.-C. Notre-Seigneur Jésus-Christ.	Our Lord Jesus Christ.
Nt. Négociant.	Merchant, m.
Nte. Négociante.	Merchant, f.

O. Ouest.
O.-N. Ouest-nord.
O.-S. Ouest-sud.
P. S. Post-scriptum.
R. P. Révérend père.
S. Sud.
S. A. I. Son Altesse Impériale.
S. A. R. Son Altesse Royale.
S. A. S. Son Altesse Sérénissime.
S.-E. Sud-est.
S. Em. Son Eminence.
S. Ex. Son Excellence.
S. G. Sa Grandeur.
S. H. Sa Hautesse.

S. M. Sa Majesté.
S. M. B. Sa Majesté Britannique.
S. M. C. Sa Majesté Catholique.
S. M. I. Sa Majesté Impériale.
S. M. R. Sa Majesté Royale.
S. M. S. Sa Majesté Suédoise.
S. M. T. C. Sa Majesté Très-Christienne.

S. M. T. F. Sa Majesté Très-Fidèle.
S.-O. Sud-ouest.
S. P. Saint Père.
SS. PP. Les Saints Pères.
S. S. Sa Sainteté.
S.-S.-E. Sud-sud-est.
S.-S.-O. Sud-sud-ouest.

West.
West-north.
West-south.
Postscript.
Reverend father.
South.
His or Her Imperial Highness.
His or Her Royal Highness.
His Most Serene Highness.
South-east.
His Eminence.
His Excellence.
His Grace (to a Bishop).
His Highness (the Turkish Emperor).
His or Her Majesty.
His or Her Britannic Majesty.
His Catholic Majesty.
His Imperial Majesty.
His Royal Majesty.
His Swedish Majesty.
His Most Christian Majesty.

His Most Faithful Majesty.
South-west.
Holy Father.
The Holy Fathers.
His Holiness.
South-south-east.
South-south-west.

KEY TO EXERCISES IN LESSONS IN FRENCH.

EXERCISE 156 (Vol. II., page 277).

1. Avez-vous acheté cette maison à l'insu de votre père? 2. Je l'ai achetée à son insu. 3. Avez-vous oublié de fermer la porte de devant? 4. J'ai fermé la porte de devant et la porte de derrière. 5. J'ai apporté tous mes livres, excepté deux ou trois. 6. Votre frère occupe-t-il le devant de votre maison? 7. Il occupe le derrière. 8. Qui avez-vous rencontré derrière cette maison? 9. Je n'ai rencontré personne derrière la maison. 10. Ce monsieur demeure-t-il derrière votre maison? 11. Personne ne demeure derrière notre maison. 12. Il n'y a pas de maison derrière la vôtre. 13. Avez-vous un couteau sur vous? 14. Je n'ai pas de couteau sur moi. 15. Portez-vous un couteau sur vous? 16. Je ne porte jamais de couteau. 17. M. votre frère n'a-t-il pas d'argent sur lui? 18. Il n'a pas d'argent sur lui. 19. Voulez-vous mettre ces crayons sur la table ou dessous? 20. Je les mettrai dans le tiroir. 21. Combien avez-vous donné pour ce blé? 22. Je l'ai acheté à raison de vingt-cinq francs l'hectolitre. 23. La maison de cette dame est-elle hors de la ville? 24. Elle n'est pas hors de la ville, elle est dedans. 25. Votre sœur n'a-t-elle pas mis les assiettes sur la table? 26. Elle a mis les assiettes sur la table et les cuillers dessous. 27. Avez-vous fait réparer votre maison?

EXERCISE 157 (Vol. II., page 298).

1. Is it you, Madam, who have called your servant? 2. It is not I who have called him. 3. Is it you, my friend, who wish by all means to go to Spain? 4. It is not I, it is my cousin. 5. Is it not he who has warned that sailor of his danger? 6. It is not he, it is I who have warned him of it. 7. Is it you whom you expect from day to day? 8. It is not you, it is they whom I expect. 9. Is it you, Madam, who have overwhelmed us with benefits? 10. It is not I, Ladies. 11. Is it not in Italy, that you have made his acquaintance? 12. It is not in Italy, it is in Russia. 13. Is it you, Ladies, or your cousins whom we saw at the ball? 14. It is we, it is not our cousins whom you have seen. 15. Do you not know those two gentlemen? 16. I know him (the gentleman) who is speaking to Mrs. L. 17. Is it my you who have received a wound in the war? 18. It is not I, it is my neighbour. 19. Is it not you who have explained that sentence to us? 20. Is it you, Sir, who live at No. 18? 21. It is not I who live there. 22. Do you hear those musicians? 23. I hear him (the one) who sings. 24. I do not hear well him who plays. 25. We hear those who prelude.

EXERCISE 158 (Vol. II., page 298).

1. Est-ce vous, mon ami, qui m'avez averti de mon danger? 2. Ce n'est pas moi qui vous en ai averti. 3. Est-ce eux que vous attendez de jour en jour? 4. Ce n'est pas eux que nous attendons. 5. Est-ce vous qui avez fait cela? 6. Ce n'est pas nous, c'est vous qui l'avez fait. 7. Est-ce en Angleterre que vous avez acheté ce chapeau? 8. Ce n'est pas en Angleterre, c'est en Allemagne. 9. N'est-ce pas en Russie que vous avez fait connaissance avec lui? 10. Ce n'est pas en Russie, c'est en Italie. 11. Était-ce vous qui nous appeliez? 12. Ce

n'était pas nous, c'était lui. 13. Ne connaissez-vous pas les deux Polonais qui lisent? 14. Je connais celui qui est près de vous. 15. Est-ce là la dame que vous attendiez? 16. Ce n'est pas elle. 17. Est-ce vous, Messieurs, qui avez comblé mon frère de bontés? 18. Ce n'est pas nous, Monsieur; nous n'avons pas le plaisir de le connaître. 19. Est-ce vous qui avez été blessé au bras? 20. Ce n'est pas moi. 21. N'entendez-vous pas ces deux dames? 22. J'ai entendu pas celle qui chante. 23. J'entends celle qui joue. 24. Est-ce vous qui êtes venu chez nous ce matin? 25. Ce n'est pas moi, j'étais à Londres alors. 26. Est-ce vous, Monsieur, qui nous avez fait ce plaisir? 27. Ce n'est pas moi, c'est ma sœur. 28. Était-ce votre fils qui désirait à toute force aller à Londres? 29. Ce n'était pas lui, il est maintenant en Allemagne. 30. Est-ce vous qui avez écrit cette lettre? 31. Nous n'avons pas écrit de lettre. 32. Qui demeure au No. vingt? 33. C'est moi (J'y demeure). 34. Est-ce nous que vous avez vus? 35. Ce n'est pas nous que j'ai vus.

EXERCISE 159 (Vol. II., page 298).

1. Do you know these strangers? 2. Yes, Sir, they are our neighbours' brothers? 3. Are they not Scotch? 4. No, Sir, they are Swiss. 5. Did not some Scotchmen make you a present of this cap? 6. No, Sir, they are Swiss. 7. Is it not your servant who stole wine from you? 8. It is not he, it is his brother. 9. Is it not he who has taken your preserves? 10. It is not he, it is his children. 11. Are not those the children whom you caught stealing your sugar? 12. They are their brothers. 13. Are they not cousins? 14. They are not cousins, they are brothers. 15. What are those silk goods? 16. They are goods which have just been sent to us. 17. Is not Lyons a fine city? 18. It is a large and beautiful city. 19. Is not that the handkerchief which you have lost? 20. I think so. 21. Do not your windows look on the garden? 22. Yes, Sir, they look on the garden. 23. Is it not our wheelwright who has made that wheel? 24. It is not he who has made it. 25. It is our friends who have broken it, and it is the joiner who has made it.

EXERCISE 160 (Vol. II., page 298).

1. Cette dame est-elle la sœur de votre ami? 2. Non, Monsieur, c'est une étrangère. 3. Qui sont les deux messieurs qui parlent à Mlle votre sœur? 4. Ce sont des Suisses. 5. Sont-ce là les messieurs que vous avez invités? 6. Ce sont eux. 7. Ne connaissez-vous pas cet homme? 8. Je le connais très bien, c'est l'homme qui m'a volé mon vin. 9. Qu'est-ce que l'Italie? 10. C'est le jardin de l'Europe. 11. N'est-ce pas là la lettre que vous aviez l'intention de porter à la poste? 12. Non, Monsieur, c'en est une autre. 13. Est-ce que la ville du Havre est belle? 14. Oui, Monsieur, le Havre est véritablement une grande et belle ville. 15. N'est-ce pas là l'homme que vous avez surpris à voler votre fruit? 16. Ce n'est pas lui, c'est un autre. 17. N'est-ce pas là la casquette que vous avez achetée? 18. Oui, Monsieur, je crois que oui. 19. Les fenêtres de votre chambre ne donnent-elles pas sur la rue? 20. Non, Madame, elles donnent sur le jardin. 21. Les fenêtres de votre salle à manger ne donnent-elles pas sur la cour? 22. Non, Monsieur, elles donnent sur le lac (or c'est sur le lac qu'elles donnent). 23. Est-ce ce petit enfant qui a pris vos confitures? 24. C'est son frère et sa sœur. 25. Qu'est-ce que ces gravures? (Que sont ces gravures?) 26. Ce sont des gravures que j'ai achetées en Allemagne. 27. Ces messieurs sont-ils écossais? (des Ecossais?) 28. Ils ne sont pas écossais, ils sont italiens. (Ce ne sont pas des Ecossais, ce sont des Italiens). 29. Ces dames sont-elles écossaises? 30. Ce sont les dames italiennes (les Italiennes) qui sont arrivées hier. 31. Qu'est-ce que Marseille? 32. C'est une des plus belles villes de France. 33. N'est-ce pas votre tailleur qui a fait cet habit? 34. Ce n'est pas lui, c'est un tailleur anglais qui l'a fait. 35. C'est votre ami qui a cassé ma montre.

EXERCISE 161 (Vol. II., page 330).

1. If we remained longer here, we should fear to be in your way. 2. You are not at all in our way (you do not disturb us); your society is very agreeable to us. 3. Have not you and your brother been too prodigal? 4. He and I, on the contrary, have been very economical. 5. Are you not wrong to incommode that gentleman? 6. We do not wish by any means to incommode him. 7. Is my arm in your way, Sir? 8. No, Sir, we have room enough, you do not incommode me. 9. Should you not adapt yourselves to circumstances? 10. She and I (we) do our best to adapt ourselves to them. 11. Does not that young man persist in his resolution? 12. He and I (we) persist in it. 13. Do you both persist in remaining here? 14. We both persist in it. 15. Is that man badly off? 16. He was uncomfortably situated a year ago. 17. Be under no constraint, Sir. 18. I am never under constraint, Sir. 19. Does my brother disturb you? 20. No, Sir, he does not disturb me. 21. I should not wish to disturb you. 22. Excuse me, if I disturb you. 23. You and your partner sold your goods at a loss. 24. You and I sell always at a profit. 25. Your father, your brother and I have bought goods.

EXERCISE 162 (Vol. II., page 330).

1. Est-ce que nous vous gênons, mon frère et moi? 2. Non, Monsieur, vous ne nous gênez pas; nous sommes bien aises de vous voir.

3. Ne craignez-vous pas de déranger votre ami? 4. Nous craignons de le déranger, il a beaucoup à faire. 5. Est-ce que mon pied vous gêne, Monsieur? 6. Non, Monsieur, votre pied ne me gêne pas. 7. Irez-vous en Allemagne cette année, vous et M. votre frère? 8. Lui et moi, nous avons l'intention d'y aller. 9. Lui, vous et moi, nous devrions écrire nos leçons. 10. Ne devriez-vous pas, vous et vos amis, vous prêter aux circonstances? 11. Nous devrions le faire s'il était possible. 12. Est-ce que je ne vous dérange pas, Monsieur? 13. Vous ne me dérangez nullement. 14. Mon petit garçon ne vous dérange-t-il pas? 15. Il ne me dérange pas. 16. Il ne dérange personne. 17. Votre associé ne vend-il pas ses marchandises à perte? 18. Il ne vend jamais à perte. 19. Lui et moi, nous vendons toujours à profit. 20. Persistez-vous dans votre résolution? 21. Votre ami et moi, nous persistons dans notre résolution. 22. Je ne me gêne jamais chez vous. 23. Ne vous gênez pas. 24. N'avez-vous pas tort de les gêner? 25. Je n'ai pas l'intention de les gêner. 26. Nous n'aimons pas à nous gêner. 27. Mon petit garçon et moi, nous vous générons peut-être? 28. Non, Monsieur, nous sommes bien aises de votre société. 29. Est-ce que je vous dérange? 30. Non, Monsieur, vous ne nous gênez pas. 31. Est-ce que je dérange M. votre père? 32. Non, Monsieur, vous ne dérangez personne. 33. Excusez-moi, Monsieur (or pardon, Monsieur), si je vous dérange. 34. N'avez-vous pas été fort prodigues? 35. Non, Monsieur; je vous assure que votre fils et moi, nous avons été bien économes.

MECHANICS.—IX.

THE THREE ORDERS OF LEVERS.—THE COMMON BALANCE.

OF Levers there are commonly reckoned three kinds, of which Figs. 45, 47, and 49 furnish illustrations, in which the bar extends to equal distances on either side of the fulcrum, F ; in order that, the centre of gravity being supported at F , it may not by its weight interfere with the action of the Weight and Power. In that case we must consider the true lever only as so much of the bar as is between r and w , or r or w and F , the points of application and the fulcrum. These levers are said to be of three orders.

First Order.—When the fulcrum is between the Power and Resisting Weight. **Second Order.**—When the fulcrum is at one end, and the Weight nearer to it than the Power. **Third Order.**—When the fulcrum is again at one end, but the Power nearer to it than the Weight.

First Order.—The Condition of Equilibrium in this we have already determined in connection with the balls in Lesson VI. (Fig. 44). The Resisting Weight (Fig. 45) is to the Power *inversely* as w or r to r or F , or the weight multiplied by the arm, w or r , is equal to the power multiplied by the arm r or w . Of this kind of lever the examples are very numerous. In Fig. 46 the crowbar is used as a lever, by means of the fulcrum in the middle, to lift the chest, the push of the hand and the weight of the chest, both parallel forces, acting downwards. A poker put into a fire to raise the coals is also an example, the bar of the grate being the fulcrum; the handle by which a pump is worked is another. A pair of scissors is a double lever of this kind, of which the connecting rivet is the fulcrum, the force of the finger and thumb at one end being the power which overcomes the resistance of the cloth to be cut. A gardener at work with his spade is also a familiar illustration. After he has driven it into the ground he forces the handle downwards, making a temporary fulcrum of the harder earth at its back. In all the principle is the same.

Second Order.—This is a no less important class; but the Power and Resistance, not as in the former case, act in *opposite* directions, as in Fig. 47; and this accounts for the fulcrum having both these forces on one side of it, for, as I have shown in the last lesson, the forces being opposite, the resultant, which,

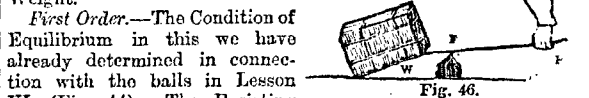


Fig. 45.

Third Order.—Here again the Resistance and Power, as in Fig. 49, are parallel forces acting in *opposite* directions, and the condition of equilibrium is the same as in the last order, and for

a similar reason; but the mechanical advantage is against the power, which from being nearer the fulcrum must be greater than the resistance. The best examples are found in the limbs of animals. The leg of a horse is a pair of levers with a joint in the middle, which he can make into one or use separately as he likes by means of the muscles attached to them along their lengths. The fulcrum is in the shoulder-joint or the knee-joint, and the resistance is at the hoof when he puts forth his strength to pull a load.

If a man stretches his arm out straight, and so lifts a weight, that weight is the resistance; the shoulder is the fulcrum, and he must put forth a strength by his muscles in the middle greater than the weight before he succeeds in lifting it. If he moves only the lower joint, as in Fig. 50, his elbow is the fulcrum, and the power is midway.

It may be asked, Why ever use a lever in which the power is at a mechanical disadvantage? The answer to be given is, that to lift a large weight by a small force is not the only object aimed at in mechanism, natural or artificial. It is as often desirable to give the end of a lever a very rapid motion, and this can be done with most advantage when it is of the third order. The amount of force

put forth in such cases is no consideration in comparison to rapidity of action, especially in animal mechanics. To strike a swift and smart blow with the closed hand, or with a sword in the hand, as it is often necessary to do, a lever of the third order is the most effective.

Levers of the various orders are often worked *together*, so as to make compound levers, the resistance end of one working into the power end of the other. In this way the effect of a small power is often very largely multiplied, and a very great resistance easily overcome. Such a compound lever is that in Fig. 51, where all are of the first order, three fulcrums at F_1, F_2, F_3 , a power at r overcoming a resistance at R_1 , and there multiplied overcoming a second resistance at R_2 , and this eventually lifting the still greater weight w . The power is multiplied in the first lever *inversely* as the length of the arms, also in the second, and so also in the third. Suppose, for example, the power at r is *one pound*, and the short arm of each lever a third of the long one, then the 1 pound at r produces at the end of the long arm of the second lever at F_2 a force of 3 pounds. This again produces at R_2 in the third lever 3 times 3, or 9 pounds; and thus 1 pound eventually balances a weight of 27 pounds at w , the mechanical advantage gained by the combination being 27 to 1.

But suppose that the lengths of the arms were in the proportion of any other numbers in the several levers—say 9 to 4 in the first, 7 to 3 in the second, 5 to 2 in the third; what weight would 1 pound at r support at w ? It is not difficult to discover, if you know something about multiplying fractions. Now, in the first lever, by the principle of moments, already explained, 9 times the 1 pound at r is equal to 4 times the power produced by that pound in the second lever at R_2 ; that is to say, this second power is $\frac{9}{4}$ of a pound. But this force, for the same reason, is multiplied at R_2 in the proportion of 7 to 3, and therefore becomes $\frac{9}{4}$ of $\frac{7}{3}$ of $\frac{1}{1}$ of a pound, and this eventually balances a weight at w of $\frac{9}{4}$ of $\frac{7}{3}$ of $\frac{1}{1}$ of that unit, or, on making the calculation, the 1 pound balances 13 pounds 2 ounces. And, of course, what is true of these numbers is true of all others, and the rule you arrive at is this—

Rule.—Multiply together the fractions which represent the ratios of the Power arms to the Resistance arms, and the product obtained is the number of pounds of the Resistance which each pound of the Power balances. When the Power is more than 1 pound, multiply this number into that of the pounds and fractions of a pound in it.

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The Power multiplied by the several lengths of the Power arms is equal to the Resistance multiplied by those of the Resistance arms.

And you thus have a result not unlike that established above for a single lever. And observe that this, though proved above only for a combination of levers of the *first* order, holds equally good of other combinations, mixed or unmixed, all of the second, or all of the third, or of two kinds, or of all three together. The principle of moments is true for each kind, and therefore for their combinations. For this reason I have above avoided, in the statement of the *general principle*, the terms "long arm" and "short arm," but used instead "power arm" and "resistance arm," indicating thereby the arms that work *with* the power or *with* the resistance.

The example of a combination of levers which is most likely to interest you, is the common *weighing machine*, used for weighing loaded market carts, or luggage at railway stations. In Fig. 52 is a ground-plan of this piece of mechanism, where at A, B, C, D, the four corners of the bottom of a shallow box, are the fulcrums of four levers of the second order, which meet, two and two, on either side at F , and are joined across by a stout steel pin, by which they are also connected with the lever of the second order, E , which has its fulcrum at E . The end, G , of this lever is connected by a rod which ascends perpendicularly from the ground, and is attached above to the short arm of another lever—one of the first order, generally a steelyard, to be afterwards described—to the longer arm of which the weighing

for equilibrium, must pass through the fulcrum, cannot lie between them. Moreover, as it has been shown there that the distances of O from A and B (see Fig. 44, page 304) are *inversely* as the forces, so here the distances r or w must be *inversely* as the power and resistance, or, what is equivalent, the power multiplied by its arm r or w is equal to the weight multiplied by its arm w or r . In this order of levers, as in the former, it should be observed that there is a mechanical advantage gained—a larger weight at w is overcome by a lesser at r , a result always to be secured where the larger arm can be given to the power.

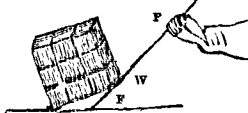


Fig. 48.

As an example of this lever, take the crowbar in the illustration in Fig. 48, used differently from that in Fig. 46. The workman makes the ground at the point of his bar his fulcrum, throws the weight of the chest about the middle, and, instead of pushing downwards with his hand, lifts upwards. The mechanical advantage is clearly on his side. The oar of a boat is also a lever of the second order; the arms of the oarsman furnish the power; but most persons at first imagine that the rowlock is the fulcrum. This is natural, for it looks very like one, but that it is not such is evident from the fact that the boat is the thing he wants to move. To spurt the water about with the blade is not his object, but with each stroke he makes a temporary fulcrum of the water, by which he imparts a smart blow to his boat, and sends it ahead. The fulcrum is then in the middle, and the resistance in the middle, and the power at the other end. A nut-cracker furnishes another instance—the fulcrum at the joint, the resisting nut in the middle.

Third Order.—Here again the Resistance and Power, as in Fig. 49, are parallel forces acting in *opposite* directions, and the condition of equilibrium is the same as in the last order, and for

a similar reason; but the mechanical advantage is against the power, which from being nearer the fulcrum must be greater than the resistance. The best examples are found in the limbs of animals. The leg of a horse is a pair of levers with a joint in the middle, which he can make into one or use separately as he likes by means of the muscles attached to them along their lengths. The fulcrum is in the shoulder-joint or the knee-joint, and the resistance is at the hoof when he puts forth his strength to pull a load.

If a man stretches his arm out straight, and so lifts a weight, that weight is the resistance; the shoulder is the fulcrum, and he must put forth a strength by his muscles in the middle greater than the weight before he succeeds in lifting it. If he moves only the lower joint, as in Fig. 50, his elbow is the fulcrum, and the power is midway.

It may be asked, Why ever use a lever in which the power is at a mechanical disadvantage? The answer to be given is, that to lift a large weight by a small force is not the only object aimed at in mechanism, natural or artificial. It is as often desirable to give the end of a lever a very rapid motion, and this can be done with most advantage when it is of the third order. The amount of force

put forth in such cases is no consideration in comparison to rapidity of action, especially in animal mechanics. To strike a swift and smart blow with the closed hand, or with a sword in the hand, as it is often necessary to do, a lever of the third order is the most effective.

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counterpoise is attached. We thus have a triple combination of levers, the first four at the bottom, by being united at *r*, being virtually one lever.

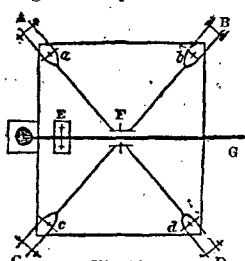


Fig. 52.

yard, producing equilibrium, and making known the weight of the cart or luggage.

For example, taking the four platform-levers as one, suppose the resistance arms in the combination are each one-fifth of the power arms, then evidently, as proved above, the resistance is 5 multiplied three times into the power—that is to say, 1 pound above on the steelyard balances 125 pounds, or 1 cwt. and 13 pounds on the platform. If the proportion were one-eighth, it would balance 4½ cwt. 8 pounds, which strikingly illustrates the mechanical advantage gained in these machines. We will now consider the common balance, and, in the next lesson, examine the principles of other weighing instruments, bent levers, and the wheel and axle, and their combinations.

THE COMMON BALANCE.

Of weighing instruments, the scale, or common balance, claims the first attention. It is a lever of the first order, in which the counterpoise, or power, is equal to the resistance, or substance weighed. There is first the beam, *A B*, at the ends of which (Fig. 53) are the hooks, from which hang the chains or cords which support the pans or scales below. Since the weights in the scales are required to be equal, the fulcrum, *r*, should be in the middle of the beam, equally distant from the points of suspension of the chains, else the balance is fraudulent, for the purchaser who has his tea or sugar served to him from the end of the longer arm is getting less than his money's worth. I shall direct your attention to the case in which the line joining the points, *A B*, of suspension passes through the supporting point of the fulcrum, as it is the simplest; and balances of this kind, as you will see, have a peculiar advantage as to their sensibility.

Now, it is evident, since *A B* is bisected at *r*, and the scales, chains, and weights on either side are equal forces, that whatever be the position in which I place the beam, the resultant of these forces must pass through *r*, and, being there resisted, leave the whole apparatus at rest. Moreover, if the centre of gravity of the beam is at *r*, so far as its weight is concerned, there will be equilibrium in every position. But such a pair of scales would be utterly useless, since, for equal weights, the arms should rest only in an horizontal position.

How, then, is this latter object accomplished? By having the centre of gravity of the beam below the fulcrum, when the arms are horizontal. The desired position is then one of stable equilibrium (see Lesson VII.), to which the beam will revert when displaced from it, and in which the line *r g* is perpendicular to the line *A B*, joining the points of suspension of the scales. For a good pair of scales, therefore, there must be stability as well as accuracy.

But a balance should also be sensitive—should indicate a slight difference of weights in the scales. How is this secured? Suppose the scales equally loaded, and that a slight additional weight (call it *p*), is thrown into the scale *a* in Fig. 53, causing it to decline through some angle agreed upon as sufficient to indicate a difference of weights to the eye. As *A* descends, the centre of gravity, *g*, of the beam ascends at the other side, until its weight (call it *w*), acting at *c*, balances *p*. We have thus a new lever, *A D*, the fulcrum of which also is *r*, and at whose ends the forces *p* and *w* act. And since in that case, as proved in the last lesson, *p* multiplied by *A r* must be equal to *w* multiplied by *r D*, the length *A B*, and the weight *w*, of the beam being the same in any number of balances in a manufac-

tory, that one which moves through the angle agreed on, with the smaller additional weight *p*, must also have *r D* smaller; or, which comes to the same thing, since the angles of the triangle *r g D* are given, that at *r* being a right angle, it must have *r g* smaller. Everything else, therefore, being the same, that balance has the greater sensibility, the centre of gravity of whose beam is as little as possible below the fulcrum. Summing up, then, we have for the requisites of a good balance the following:—

1. For Accuracy.—That the arms be equal.
2. For Stability and Horizontality.—That the centre of gravity of the unloaded beam be below the fulcrum, on a line through its supporting point, perpendicular to that which joins the points of suspension of the scales.
3. For Sensibility.—That the centre of gravity of the beam be as little as possible below the fulcrum.

You will observe that the second and third conditions oppose each other. The lower the centre of gravity is below the fulcrum, the greater is its stability, but the less its sensibility. Both qualities are essential, and are therefore secured only by a compromise; the centre for sensibility may approach the fulcrum, but not too close; for stability it keeps off, but not too far.

Further, observe the consequence of making the line joining the points, *A B*, of suspension pass through the fulcrum. However the pans are loaded, it is only the difference (*p*) of the weights in them that affects the sensibility. The resultant of the lesser one in *B*, and of as much of that in *A* as is equal to it, passes through and is resisted by *r*, and affects neither stability nor sensibility. If *A B* were not to pass through *r*, then these weights would have influence as regards these qualities, but that kind of balance we are not here considering.

A most important question is, how to detect fraud in a pair of common scales. The arms in that case not being equal, all the purchaser has to do, if he doubts the honesty of his tradesman, is, after the first weighing, to make the shop weight and the substance weighed change pans. If the two balance each other equally as before, the scales are honest—the arms are equal; but if not, fraud is proved.

But how, in that case, may the purchaser still get his true pound of tea, or sugar, or other commodity? The shop weight being supposed true, the imperial stamped weight, let the deficient tea be weighed as before from the longer dishonest arm. Leaving it then in the scale, let him require the shopman to remove the weight from the other scale, and fill it with tea until that in the first one is balanced. He now has a true pound of tea balancing the deficient pound, as the imperial weight first did. Let him carry off this pound, and he has his money's worth.

But there is another way by which the purchaser may not only get his due quantity, but turn the tables on the vendor, and by the very fraudulent balance itself get more than his money's worth. Suppose he is buying two pounds; then let him have one pound weighed in one scale and the other pound in the other scale; it so happens that invariably the two together are more than two pounds. The reason you will understand by an example. Suppose one arm is 14 inches long, and the other 15 inches. Then, weighed at the latter arm, the purchaser gets only 1½ lbs., which is less, but at the former 1½ lbs., which is more than one pound. But by the latter he gains a ¼th of a pound more than he is entitled to, while at the former he loses only 1/16th. So on the whole, since a ¼th is greater than a 1/16th, he is a gainer; he has caught the vendor in his own trap. Or, you may add up the two fractions 1/16th and 1/16th, and the sum you will find to be greater than 2 by the fraction 1/16th. And what is true of these numbers is true of all others, which represent the proportion of the arms—what you lose at the long arm is more than recompensed by what you gain at the short one.

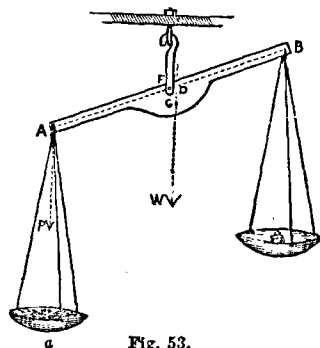


Fig. 53.

LESSONS IN CHEMISTRY.—XXIV.

METALS PROPER—continued.

BISMUTH.

SYMBOL, Bi — COMBINING WEIGHT, 210 — SPECIFIC GRAVITY, 9.8.

THIS metal exhibits a resemblance to arsenic and antimony, and is therefore sometimes classed with them in one group. It occurs chiefly in a native state in quartz rock, and is found in central Germany. To extract the metal from the ore, it is only necessary to raise the temperature until the bismuth fuses, and in its liquid condition it leaves its matrix and sinks to the bottom of the furnace. The metal has the appearance of lead, perhaps it exhibits a little warmer tint; it is hard and brittle; at 264° Cent. it melts. If the crust of a vessel of molten bismuth, partially cooled, be broken, and the still liquid metal poured out, the cavity will be found lined with peculiar hollow cubical crystals, which present the appearance of "the Greek pattern." The crystals are not true cubes, but rhombohedra with large angles, only being 2° 20' from right angles.

At the moment of solidification this metal expands considerably, hence it is always used in making alloys which are employed in taking casts. The well-known fusible metal, which melts at a temperature a little below that of boiling water, is composed of two parts of bismuth, one of lead, and one of tin; before this alloy fuses it becomes a paste, and when in this condition if a medal be pressed into it a perfect cast is obtained. The expansion of the alloy on solidifying permits the medal to be removed with ease. It is in this manner that the cliché moulds used in electrotyping are produced. Nitric acid readily oxidises bismuth, and dissolves the oxide it forms.

Hydrochloric and sulphuric acids likewise dissolve the bismuthous oxide; but upon adding water to these solutions the water displaces a portion of the acid from the salt, and the double salt thus formed falls as a precipitate.

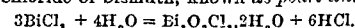
Bismuthous Oxide (Bi_2O_3) is a yellow powder produced when the metal is roasted in the air.

Bismuthic Oxide, or the Peroxide of Bismuth (Bi_2O_5), is produced by acting on the former oxide by potash. On passing chlorine, a red precipitate falls; this is washed with nitric acid, to remove any traces of the lower oxide.

This red powder is the hydrated peroxide; when heated it gives up its water and becomes brown. As in the case of antimony and arsenic, there seems to be an intermediate oxide which may be considered a compound of the two.

Bismuthic Sulphide (Bi_2S_3) occurs native as Bismuth Glance. It may be artificially produced by melting sulphur and the metal together, and it falls as a black powder when a current of sulphuretted hydrogen is passed through a solution of a bismuth salt.

Bismuthic Chloride (BiCl_3) is produced when bismuth is heated in an atmosphere of chlorine. It resembles antimonious chloride, is very deliquescent, and capable of being distilled. A large quantity of water decomposes it into hydrochloric acid and an oxy-chloride of bismuth, known as pearl white, thus—



The salts of bismuth present no marked characters; they become milky when diluted with water. Iron, zinc, copper, and tin throw down bismuth in a metallic state from its solution. The metal is easily reduced from its salts on charcoal before the blow-pipe. It appears as a brittle metallic bead surrounded by the yellow bismuthous oxide.

COPPER.

SYMBOL, Cu — COMBINING WEIGHT, 63.5 — SPECIFIC GRAVITY, 8.9.

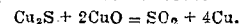
THIS useful metal occurs native in many localities, as dendritic copper, resembling a mass of rootlets; but in the neighbourhood of Lake Superior native copper is found in large masses.

The ores of copper are numerous. That which is chiefly worked in this country is copper pyrites ($\text{Cu}_2\text{S} + \text{Fe}_2\text{S}_3$). Its chief deposit is in Cornwall.

Extraction of the Metal.—This is effected by exposing the ore heated on the hearth of a reverberatory furnace to the action of the air. The copper becomes a sulphide, whilst the iron becomes an oxide. This oxide is removed with the quartz, as a fusible slag.

During this process the furnaces emit a dense cloud, known as copper smoke. It contains fumes of arsenious, sulphurous, sulphuric and hydrochloric acids, and is consequently extremely

deleterious. After the ore has been submitted to this calcining process for some time the heat is raised, and the fusion of the ore determined. The copper sulphide—mixed with some iron sulphide—sinks to the bottom of the furnace, forming the matt, which is then drawn off into water, by which means it is granulated. This coarse metal is again roasted, and the remaining iron thus oxidised; ore rich in silica is added, and the whole fused. The oxide of iron and the silica form a slag; and the copper in the form of a subsulphide—fine metal—(Cu_2S) is drawn off and cast into pigs. It only remains to free the metal from the sulphur; this is accomplished by submitting the pigs to a heat in a reverberatory furnace just insufficient to fuse them. The metal at the surface thus becomes oxidised, and when fusion takes place this action occurs—



Thus the copper is obtained. It still requires to be refined. For this end it is again fused, in order to oxidate the last traces of foreign metals, which are removed as slags; and to reduce any oxide of copper, the trunk of a young tree is thrust into the molten mass, the gases liberated from it deprive the oxide of copper of its oxygen, and thus the metal is procured in its pure state; this last process is termed *poling*.

The appearance of copper is well known, but when pure, as produced by the electrolytic process, it possesses a beautiful pink colour. It is very tenacious, ductile, and malleable. It melts at about 1090° Cent., and is capable of some volatilisation, imparting a green tint to the flame. At ordinary temperatures air has no action upon copper, but if heated a cupric oxide is formed, which, as it contracts more slowly than the metal beneath, comes off in scales. If ignited, finely-divided copper will burn like tinder into the black oxide.

Leaves of this metal, as we have seen, will burn in a jar of chlorine. All the alloys in which copper is a constituent have been noticed.

Cuprous Oxide (Cu_2O), or the suboxide, occurs native as "octahedral copper ore." Its colour is red. It may be artificially prepared in several ways; the most ready is, perhaps, by boiling a solution of copper sulphate, sugar, and caustic potash, in excess; the oxide falls as a red powder. It forms with acids cuprous salts, which readily take oxygen from the air, and become cupric salts. It is chiefly used to stain glass a deep red. When in a hydrated state it forms with ammonia a colourless solution, which offers a delicate test for oxygen, for it absorbs that gas and turns blue.

Cupric Oxide, the Black Oxide (CuO), is formed when heated copper is exposed to the action of the air. It falls as a light blue powder in a hydrated state, when potash is added to the solution of a cupric salt; this powder, when heated to 100°, loses its water and becomes dark brown.

It is of great service in analysis to furnish oxygen in a known quantity, to complete the combustion of organic bodies.

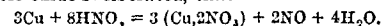
The cupric salts which this oxide forms with acids are usually green or blue, and colourless without water. Cupric oxide stains glass a beautiful green.

With ammonia it forms a blue solution, with which the characteristic bottles of a chemist's shop window are filled.

Copper Sulphate, or Blue Vitriol ($\text{CuSO}_4 + 5\text{H}_2\text{O}$), has the greatest commercial importance of all the cupric salts. It crystallises in large blue crystals; when heated it parts with its five molecules of water of crystallisation, and becomes a white powder. This powder is useful in discovering the presence of moisture, as it turns blue when combined with water. This salt is formed by the action of sulphuric acid on copper; it is largely used by the calico-printer, and is the source of all the copper pigments.

When ammonia is added to its solution, a greenish basic sulphate of copper falls—which is readily dissolved in an excess of the alkali—from the formation of a salt of a fine blue colour, which may be got in crystals, and has this composition— $\text{CuSO}_4 \cdot \text{H}_2\text{O} \cdot 4\text{NH}_3$. This salt imparts the mauve tint to pyrotechnic fires.

Cupric Nitrate (Cu_2NO_3) crystallises with six molecules of water in blue rhomboidal prisms, which are deliquescent. It is easily procured by acting on copper with nitric acid; in this action nitric oxide is liberated, thus—



Cupric Carbonate is found mixed with various quantities of

hydrated oxide in "malachite," "chessylite," and other copper ores.

Copper forms with chlorine two compounds, *Cuprous Chloride* (Cu_2Cl_2) and *Cupric Chloride* (CuCl_2). A solution of the former salt possesses the property of absorbing carbonic oxide gas. The latter salt is formed when copper-leaf is burnt in chlorine, and with two molecules of water crystallises in acicular prisms.

Sulphides of Copper.—The *Cuprous Sulphide*, or *Subsulphide* (Cu_2S), is the result of the last process but one in the reduction of copper from its ore. Native cuprous sulphide is occasionally found.

Cupric Sulphide (CuS) may be prepared artificially either by heating copper and sulphur together, or by precipitation from a salt of copper in solution. With iron it appears native as a salt of copper in solution. With iron it appears native as a salt of copper in solution. With iron it appears native as a salt of copper in solution. With iron it appears native as a salt of copper in solution.

The salts of copper are poisonous; their antidote is albumen, the white of eggs, with which they form insoluble compounds. With potash and soda a pale blue precipitate is given. This is the case also with ammonia, but with this alkali the characteristic blue appears when it is added in excess. If iron be dipped into a cupric solution it becomes covered with copper. Since iron deprives the cupric salt of its acid, its surface being covered with a layer of the corresponding ferric salt, and a coat of metallic copper overlaying it, on account of the presence of the salt between the two metals, the coat of copper shells off.

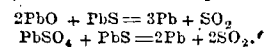
Zinc precipitates copper as a fine black powder, which exhibits metallic lustre when burnished.

LEAD.

SYMBOL, Pb—COMBINING WEIGHT, 207—SPECIFIC GRAVITY, 11.36.

Galena, the chief ore of lead, is a sulphide of the metal. It occurs in a cubic crystallisation, and possesses a marked metallic lustre. In Cornwall it is found in the clay slates, and in Derbyshire in the mountain limestone. There are mines also at Laxey, in the Isle of Man. It is usually associated with more or less sulphide of silver. The more imperfect the crystallisation of the galena, the more sulphide of silver is present.

The extraction of lead from galena is not difficult; the ore is separated from the gangue (the earthy matters in which it is embedded) by washing, and then spread on the bed of a reverberatory furnace. Some of the sulphur burns off, the lead becoming an oxide; some of the sulphide imbibes oxygen and becomes sulphate, whilst the large portion of the ore remains unchanged. When this process is sufficiently advanced, the furnace doors are closed, and the heat raised to determine in a manner the fusion of the ore. The lead oxide and sulphate react on the galena, as shown in these equations—



In each case the metal is liberated, and the sulphur escapes as sulphurous acid gas.

If there be much quartz present, which is generally the matrix of the galena, lime is added to facilitate the liberation of the metal, by causing the silica to form with the lime a fusible slag.

Extraction of Silver from Lead by Pattinson's Process.—This operation is based upon the fact that pure lead solidifies sooner than the argentiferous compound. The lead is melted in an iron pan set in brickwork, on each side of which are four or five similar pans in a row. When the metal is fused the fire is withdrawn, and as it cools the crystals of lead which form first are removed by a perforated iron ladle, and placed in the right-hand pan, the argentiferous lead being ladled into the next pan to the left. The same process is repeated in all the pans, the pure lead being ladled to the right, the silver lead to the left. The contents of the last pan to the left are then submitted to *cupellation*—that is, the metal at a high temperature is exposed to a current of air; the lead rapidly oxidises, and the film of oxide is constantly removed, until the pure silver only remains. By this process it is found profitable to extract silver when there is even as little as four ounces of the precious metal in a ton of lead.

Properties.—Lead is a bluish-white metal, very soft. It may be rolled into sheets, or drawn into pipes or wire, but its tenacity is low. It melts at 324° Cent.

LESSONS IN ENGLISH.—XXXIV.

LATIN STEMS (continued).

It is curious to observe what a controlling influence the subject-matter has in the metaphors employed and the derivations that are brought into play. We lay down railways; we set up an inn; so we set up a carriage after we have made our fortune in that shop which we set up when we were poor. As we may set up a shop, so may we open a shop; but we must begin business, or we may set up in business. Having built or rented, we may open a warehouse, as we may open a shop. So in professions—parsons occupy a pulpit, and solicitors take to the desk, while barristers hold briefs, and judges fill the bench. We draw with a pencil and paint with a brush. Pictures as well as books are composed, and both must be sketched before they are begun; but the one ends in a painting, the other in a treatise; the one is the canvas, the other is the volume. If we are charitably inclined and abound in wealth, we build a church, or found a hospital; but if we expend our money for our own pleasure or convenience, we erect a mansion and lay out pleasure-grounds. Probably we may begin to travel, and then we make a voyage by sea and take a journey by land. A young man entering one of the universities reads for honour, and studies for the church. If your son is a clergyman, he does duty on a Sunday; but if he is a dissenting minister, he preaches. A Methodist minister travels, a minister of the Establishment is an incumbent; the latter has a living, the former is on a circuit. Lawyers advise, physicians prescribe, clergymen admonish, and confessors direct. A ship impelled by a steam-engine sails, a train drawn by a steam-engine runs. Handicraftsmen receive their remuneration in wages, clerks in salaries, lawyers in fees, and ministers of religion in stipends.

Emolument, a term always applied to the receipts of the higher classes, reminds one of the time when there was in each manor or vicinity one mill, the lord or owner of which received as his pay either a portion of the flour there ground or its equivalent in money. Hence *emolument*, properly that which comes out of the mill-stone, came to denote gain from office or high employment.

This fact leads to the observation that words to a full mind are singularly suggestive; they are also singularly conservative, keeping and tacitly transmitting from age to age facts and history which relate to their origin, and have something to teach respecting ancient manners and customs. Gray has said—

"The curlew tolls the knell of parting day."

It is equally true that the word *curfew* (French, *couvre-feu*, put out the fire, or fire-extinguisher) preserves a recollection of a day long since passed and gone, when the Norman, being sovereign lord of England, published his behest that at a fixed moment the fires of the Saxon peasantry should be extinguished.

Stipulation (Latin, *stipula*, a straw) preserves an indirect record of the legal custom once prevalent of presenting a straw as a token of the delivery of possession to one who had purchased an estate; and who keeping that straw as a token of his proprietorship, regarded it as the condition on which he held the land.

In the phrase "signing a deed," you have a trace of the times when men unable to write their name, made instead the sign of the cross in attestation of the part which they took in the matter.

Calculation (Latin, *calculus*, a little stone) recalls the old custom of employing pebbles (like the little balls in the abacus) by which to perform questions of arithmetic (Greek, *arithmos*, a-rith'-mos, a number), or the science of number.

His library may remind the student of the primitive period when the rind or bark (Latin, *liber*) of trees served instead of the then unknown parchment and paper.

Latin Words.	Meanings.	Stems.	English Words.
Senex (senia)	old	seni	senility.
Sentio	I feel	sent	sentient.
Sensus	felt	sens, sent	sensation, dissent.
Sequitur	I follow	sequ	obsequies, subsequent.
Secutus	followed	secut	persecute, prosecute.
Silus (sid'ris)	a star	sider	siderical.
Silva	a wood	sily	silvan.
Similis	like	simil	similar, similitude.
Simul	at the same time	simul	simultaneous.

Latin Words.	Meanings.	Stems.	English Words.
Simulo	I feign	simul	simulation, dissimulation.
Socius	a companion	soci	social, society.
Sol (solis)	the sun	sol	solar, solstice.
Solor	I comfort	sol	solace, console.
Solus	alone	sol, soli	sole, solitude, soliloquy.
Solvere	I loose	solu	dissolve.
Solutus	loosed	solu, solut	soluble, dissolve.
Somnus	sleep	somn	somniferous.
Sopor (soporis)	heaviness	sopor	soporific.
Sorbeo	I suck in	sorb	absorbent.
Sorptus	sucked in	sorpt	absorption.
Sors (sortis)	a lot	sort	sort, assort, consort.
Sparsus	scattered, sprinkled	sparse, spers	sparse, disperse, aspersion.
Species	a form	speci	species, specific.
Specio	I see	speci	specious.
Spectus	seen	spect	aspect.
Specula	a watch-tower	specul	speculate.
Spero	I hope	sper, spair	desperate, despair.
Spiro	I breathe	spir	respiration, expire.
Spondeo	I vow, promise	spond	respond.
Sponsus	ruined, betrothed	spons	response, sponsor, spouse.
Stillo	I drop	stil	distil.
Stinguo*	I put out	stingu	extinguish.
Stinctus	extinguished	stinct	extinct.
Stipula	a straw	stipul	stipulate.
Stirps	root of a tree	stirp	extirpate.
Sto	I stand	stut, slant, stic	stature, distant, solstice.
Stringo	I bind	string	stringent.
Strictus	bound	strict	strict, restrict.
Struo	I pile up	strue, stroy	construe, destroy.
Structus	piled up	struct	structure.
Stultus	foolish	stult	stultify.
Suadeo	I advise	suad	persuade, dissuade.
Suavis	advised	suas	persuasion.
Suavis	sweet	suav	suavity.
Sumo	I take	sum, sumpt	assume, assumption.
Surgo	I rise	surg	insurgent.
Surrectus	risen	surrect	resurrection.
Tango	I touch	tang, ty	tangent, contiguous.
Tactus	touched	tact	tact, contact.
Tardus	slow	tard	tardy, retard.
Tego	I cover	leg	integument.
Tectus [ris]	covered	tect	protect.
Tempus (tempo-)	time	tempor	temporal, contemporary.
Tendo	I stretch	tend, tent, tens	tend, attend, distend, extend, tent, extent, intense.

Subsequent properly denotes that which follows immediately. The force of *immediately* is given by the *sub*. This word reminds me of a defect in the English language; we have no adjective equivalent to the adverb *after*, no adjective which denotes the relation of afterwards simply, apart, that is from the question whether the sequence is near or remote. Commonly, *subsequent* is so used.

Simulation and *dissimulation*, both from *simulo*, I feign, or put on a character, differ thus: *simulation* signifies pretending to be what you are not; and *dissimulation* concealing what you are. They have both the same purpose—namely, to produce a false impression, to mislead; and so are both wrong.

"Hide thee, thou bloody hand,
Thou perjured, and thou simulator of virtue;
Thou art incestuous."—Shakespeare, "Lear."

The way in which a metaphor may cloak a moral misdemeanour is exemplified in the following quotation, where dissimulation is made to seem almost a virtue by reference to the propriety of keeping your own hand unseen while playing at cards:—

"Simulation and dissimulation are the chief arts of cunning; the first will be esteemed always by a wise man unworthy of him, and will be therefore avoided by him in every possible case; for to resume my Lord Bacon's comparison, simulation is put on that we may look into the cards of another; whereas dissimulation intends nothing more than to hide our own."—*Dolingbroke*.

Our word *sort* comes to us from the Latin *sors*, through the French *sorte*, which means kind or species with special reference to quality, as is exemplified in the phrase "of what sort?" From this idea of quality is derived the application of the word as found in "to sort," "to assort."

"And when my careful eye I cast upon my sheep,
I sort them in my pens, and sort'd so I keep."—*Drayton*.

*The common forms in composition are *extinguo* and *extinctus*.

"An adjective is by nature a general and in some measure an abstract word, and presupposes the idea of a certain species or assortment of things, to all of which it is equally applicable."

Smith, "Formation of Languages."

Sparse is a word not often used but convenient. It is specially applicable when in the thing spoken of the idea of sprinkled or scattered, the notion "here and there," the notion "up and down," the notion "in different parts," "confusedly," "without order," is implied or intended: these are cases in which our term *sparse* does not meet the want.

"There are doubtless many such soils *sparingly* through the nation."—*Evelyn*.

Contiguous differs from both *adjacent* and *near*. *Near* conveys the common idea of proximity. But that which is near does not touch, whereas the idea of touching is essential in contiguity. But *contiguity* implies not merely that A touches B, but also that B touches A; but a thing is *adjacent* when it lies up to another thing, whether it touches that other thing or not. As in many cases the differences here are very much differences of conception, you may conceive and so speak of that which is adjacent as being also contiguous, though things so lying can scarcely be thought of as being near; yet may proximity be predicated of them, inasmuch as proximus means next, that is nearest, the one thing of a series which comes next or nearest to another. It may happen that the next is also contiguous, or actually touching. Two parishes are near each other; two districts of those two parishes are adjacent; two limits of those two districts are actually contiguous.

EXERCISES IN COMPOSITION.

Words with their proper Prepositions.

Words.	F.R.
Dash against, upon,	dask, a blow.
Deal in, by, with,	dehan, to separate.
Debar of, from,	barre, a bar.
Decide on,	cedo, I cut.
Defend against, from,	fendo, I cleave.
Deficient in,	facio, I make.
Defraud of,	fraudo, I cheat.
Demand of,	mando, I consign.
Denounce against (a person) or (a thing),	nuntius, a messenger.
Depend on,	pendo, I hang.
Deprive of,	privo, I deprive.
Derogate from,	rogo, I ask.
Derogatory to,	scando, I climb.
Descended from,	servus, a slave.
Deserving of,	desiderium, desire.
Desirous of,	sto, I stand.
Desist from,	spero, I hope.
Despair of,	spolio, I strip, rob.
Despoil of,	teneo, I hold.
Destined to,	destitutus, deprived.
Destitute of,	detacher, to undo.
Detach from,	traho, I draw.
Detract from,	

Make an abstract of the narrative which ensues, and then report it by word of mouth to children or friends. If you prefer, give the substance of it in a letter to a correspondent. Take care in any case not to copy or transcribe:—

CHARLES EDWARD ENTERING HOLYROOD.

On the 13th of September the little army of Charles crossed the Forth, and, animated by every fear, the terrified men of Edinburgh made a show of standing to their colours. But this parade was not fated to last long. On the 16th, the Prince's advanced guard were at Kirkliston, within a few miles of the city, where the consternation increased every moment, until the volunteers began to bribe with sixpences every soldier they met, to take their arms to the castle. The arrival of the Prince was awaited by the Whigs with doubt and dismay, and by the Jacobites (at the head of whom was the Provost) with an exultation which they took very little pains to conceal. Certain commissioners were sent to Gray's Mill, to treat with the Highland chiefs for delivering the keys of the city on the best terms. Of what passed at the conference nothing is known, but, by a preconcerted arrangement (it is supposed) between them and the Prince, the city was surprised next morning at four o'clock. A soldier of the city guard, sentinel at the Netherbow, stopped a hackney coach that approached his post. "Open the Port!" cried the driver, "for I be-hove to get out." "You cannot," replied the sentinel, "without an order from Provost Stuart." "Provost Stuart hath ordered me to be let out," replied the driver, whipping up his horses. The soldier still remonstrated, when James Gillespie, under-keeper of the Port, said—

"Let out the coach instantly, for I have an order to that effect." "Oh, sir, 'tis well that you have the keys of the Port and must answer for it," replied the soldier, and pulled back the ponderous gate in the arch between the towers. The moment the coach passed out, a Highlander sprang in, and in the twilight, grasped the sentinel, and wrested his musket from him. It was the chieftain of Lochiel; and immediately the whole Clan Cameron, 900 strong, with swords drawn and banners displayed, all clad in their native tartan, marched up the High-street with twelve pipers before them, making the lofty houses ring, and awakening the terrified citizens with the stirring air of—

"We'll awa to Shirramuir,
And hand the Whigs in order."

About mid-day, the main body of the Highland army, making a circuit by the ancient Tower of Merchiston, marched west by the Grange Loan, a narrow road, between old walls and aged trees, and thus avoiding the castle guns, arrived in the King's Park, where the young Prince—arrayed in the national garb, which displayed to advantage his tall and handsome figure, and wearing on his left breast the Order of the Thistle—was received with acclamation by the people. Surrounded by his Highland guard—all veterans of Sheriffmuir and Glenshiel, men verging on eighty years of age, and distinguished by snow-white beards and Lochaber axes—the Prince approached the great gate of the palace, and there he paused; for, at that moment, a twenty-four pound shot, fired from the castle, struck the front wall of James V.'s Tower, near the window that lights the state apartments of Queen Mary. It dislodged several stones, and they fell together into the court. In this incident there was something so peculiarly insulting to the descendant of the Stuarts when standing on the very threshold of their desolate palace, that a simultaneous groan burst from the spectators; a shout of acclamation followed, and the Prince again approached the gate, but again paused, and looked round him irresolutely, for there was no Lord Keeper, no Earl Marischal, no Great Chamberlain, no Master of the Household, to usher him into ancient Holyrood, till a gentleman sprang from the crowd, raised his hat, and drawing his dress-sword, led the way to the state apartments, while another shout of applause burst from the people. In absence of his father, the Prince was proclaimed Regent of Britain by the heralds, at the cross, around which Lochiel, with his Camerons, and several ladies on horseback with drawn swords, acted as guard; the first for safety, the last for honour and enthusiasm. The Highlanders stayed within their camp, or, when in the city, behaved themselves with the utmost order and decorum; no outrages were committed, and no brawls of any kind ensued.—*Memorials of the Castle of Edinburgh*, pp. 225-228.

LESSONS IN BOTANY.—XXXIII.

SECTION XC.—LINACEÆ, OR FLAXWORKS.

Characteristics: Sepals five or four, either free or joined at the base, persistent; petals five or four, hypogynous, contorted in aestivation, caducous; stamens slightly monadelphous, five or four, frequently ten, of which the five external ones are fertile, the remainder barren; ovary four, five, or three-celled; cells bi-ovulate, each divided into two; ovules pendent, reflexed; styles three to five, filiform; stigmas capitate; capsule septidial; seed dicotyledonous, exalbuminous; stem herbaceous or subligneous; leaves simple without stipules; flowers regular.

This small family, composed of a few genera, is dispersed over the temperate regions of the entire world. The common flax (*Linum usitatissimum*, Fig. 247) is indigenous to Southern Europe and Northern Africa. In France and Ireland vast tracts are devoted to its cultivation. The testa contains an abundant mucilage, which confers on the seed its emollient properties. The use of linseed meal as a poultice material is very familiar. These seeds contain a fixed oil, obtainable by expression, and employed in a great variety of useful operations; it is especially useful as a vehicle for mixing paint. It is naturally a drying oil, and its drying property is further augmented by boiling with oxide of lead.

SECTION XCI.—ZYGOPHYLLACEÆ, OR BEAN CAPERS.

Characteristics: Calyx free, five or four-partite; petals hypogynous, free, equal in number to the divisions of the calyx; imbricated in aestivation; stamens double the number of the petals; ovary pluri-locular; ovule reflexed; capsule loculicidal or separating into shells; seed dicotyledonous, either exalbuminous or embryo embedded in a cartilaginous albumen; stem herbaceous or woody; leaves opposite, pinnate, furnished with stipules.

The principal member of this natural family is the guaiacum (*Guaiacum officinale*, Fig. 248-250). It is a large West Indian tree, the wood of which is exceedingly hard, and known by the commercial name of *lignum vite*.

SECTION XCII.—RUTACEÆ, OR RUEWORIS.

Characteristics: Calyx four or five-partite; petals equal in number to the divisions of the calyx, inserted upon a hypogynous or almost perigynous disc, ordinarily free; stamens equal in number to the petals, sometimes double the number; ovaries free or coherent to a variable extent; ordinarily bi-ovulate; styles distinct at their base, coherent at their summit; capsule many-valved, having a smooth cartilaginous endocarp opening by its own elasticity; seed dicotyledonous; stem ordinarily ligneous; leaves without stipules, or provided with two glands at the base of each petiole.

This order has been divided into two sub-orders, the *Rutecæ* and the *Diosmeæ*. In the former the seeds contain albumen, while the fruit has the sarcocarp and endocarp combined; but in the latter the seeds are exalbuminous, and when the fruit is ripe the sarcocarp is separate from the endocarp.

The *Rutecæ* are found in all parts of the world, the *Rutecæ* being chiefly found in the south part of the north temperate zone, while the *Diosmeæ* are for the most part natives of South Africa and Australia. Their properties are dependent on the presence of a resin and a volatile oil, occasionally mingled with a peculiar bitter principle: this is especially the case as regards the *Galipea trifoliata*, a tree which grows in vast forests on the banks of the Orinoco, and whose bark is known in commerce under the name of Angostura bark. The leaves of the *Barosma crenata*, and other natives of the Cape of Good Hope, are employed as a valuable medicine: they are known in commerce as buchu leaves. Many species of *Rutecæ* are now cultivated in Europe, among which the *Lemonia spectabilis*, a native of Cuba, and the dittany, or *Dictamnus Fraxinella* (Fig. 251), are the most remarkable. The latter is indigenous to Germany, and is noticeable for the large amount of inflammable gas which it secretes, so that if in the evening of a hot day a flame be caused to approach a mass of these plants, the combustible atmosphere around them takes fire, the plants themselves remaining uninjured.

SECTION XCIII.—XANTHOXYLACEÆ, OR XANTHOXYLS.

Characteristics: Calyx free; petals hypogynous, equal in number to that of the divisions of the calyx; convolute or imbricated in aestivation; caducous, rarely absent; stamens equal in number to the petals, or double the latter; carpels elevated on a stipes, free or coherent at their base, or sometimes completely aggregated into a many-celled ovary, each containing two or four reflex ovules; fruit various; seed dicotyledonous; embryo embedded in the axis of a fleshy albumen; radicle superior.

The *Xanthoxylaceæ* are inhabitants of the tropical and sub-tropical regions of America and Asia. They are all characterised by pungent and aromatic properties. The fruit of the *Xanthoxylon piperitum*, or pepper-like xanthoxylon, a native of Japan, is used by the Japanese instead of pepper. It is supposed to be an antidote against many poisons.

SECTION XCIV.—MENISPERMACEÆ, OR MENISPERMADES.

Characteristics: Sepals free, caducous; petals three, six, or twelve, hypogynous, usually free, sometimes absent; stamens equal in number to the sepals, rarely more; filaments free, sometimes monadelphous; ovaries many, free, uni-ovulate; ovules curved; fruit bacciform or coriaceous; seed straight or curved; embryo very large, slightly albuminous, or albumen totally absent; the stems of members of this natural order are flexible, climbing; leaves alternate, simple, without stipules; flowers ordinarily diclinous.

The *Menispermaceæ* chiefly inhabit the intertropical regions of Asia and Africa. The Colombo, or root of the hand-leaved cocculus (*Cocculus palmatus*), a member of this natural order, a native of Eastern Africa, is much employed in medical practice as a tonic, as is also the Pareira Brava root (*Cissampelos Pareira*), a native of the West Indies. The *Cocculus Indicus* of the druggists' shops is the fruit of the *Anamirta paniculata*, a native of tropical Asia, where it is much used as an agent for stupefying fish. To eat the fish thus stupefied is, however, not altogether free from danger. The active principle of *Cocculus Indicus* is *picrotoxin*, a crystalline alkaloid body scarcely less dangerous than strychnine. Many species of *Menispermaceæ* are now cultivated in European gardens, amongst which the Canadian moonseed, or *Menispermum Canadense* (Fig. 252, 253), is most prominent.

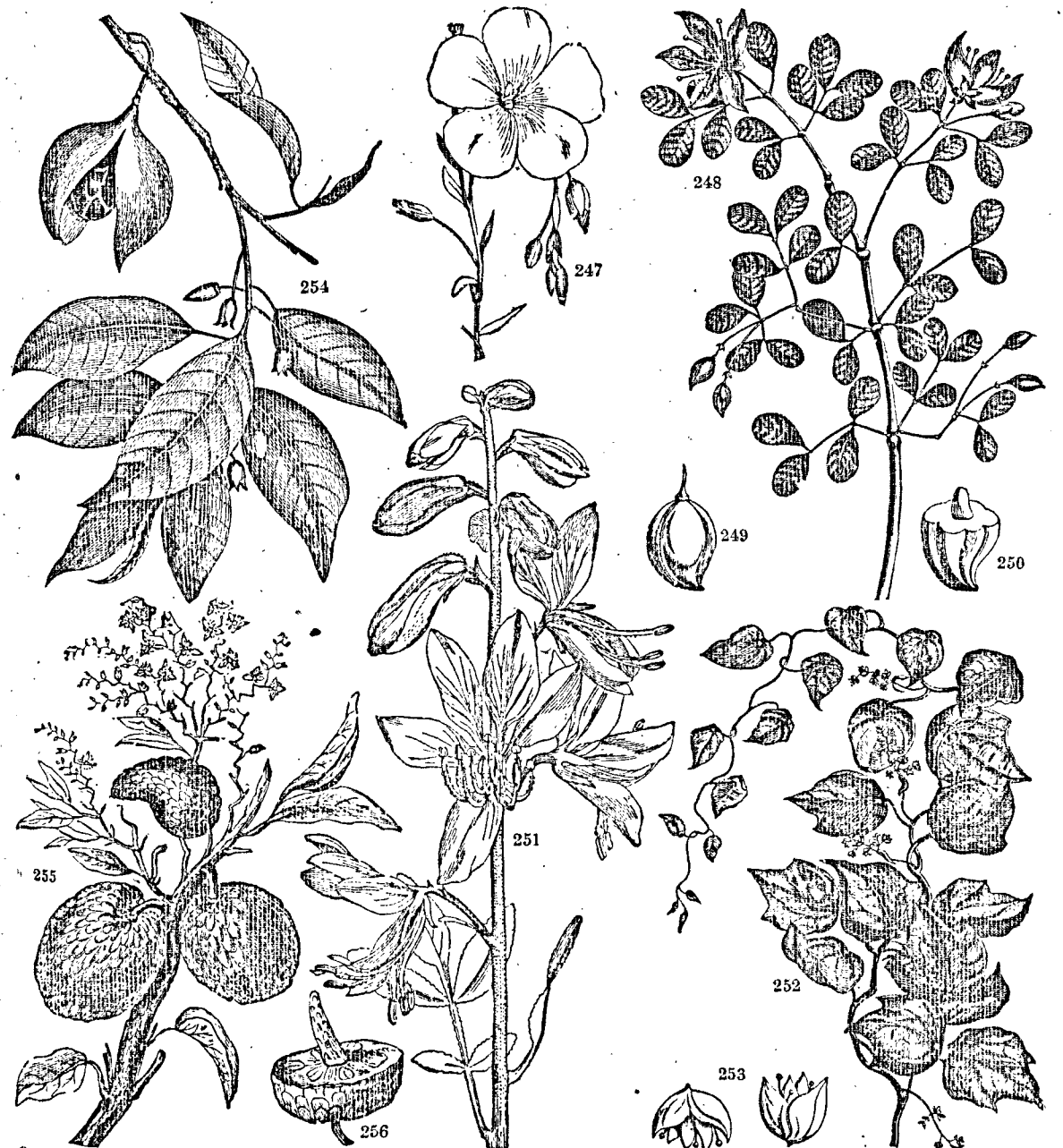
SECTION XCV.—SCHIZANDRACEÆ, OR KADSURADS.

Characteristics: Sepals three to six; petals hypogynous, six to nine, free, pluri-serial; stamens indefinite; ovaries numerous, borne on a stipes, free, occasionally coherent, bi-ovulate; ovules

many years at Chiswick, in the open air, and living through the winter without protection.

SECTION XCVI.—MYRISTICACEÆ, OR NUTMEGS.

Characteristics: Flowers dioecious; calyx three or four-partite;



247. FLAX BLOSSOM (LINUM USITATISSIMUM). 248. GUAIACUM (GUAIACUM OFFICINALE). 249. FRUIT OF DITTO. 250. SECTION OF FRUIT OF DITTO. 251. DITTANY (DICTAMNUS FRAXINELLA). 252. CANADIAN MOONSEED (MENISPERMUM CANADENSE). 253. BLOSSOMS OF DITTO. 254. NUTMEG (MYRISTICA MOSCHATA). 255. SWEET SOP (ANONA SQUAMOSA). 256. SECTION OF FRUIT OF DITTO.

pendent; berries capitate or on a spike; seed dicotyledonous; embryo straight, small, at the base of a fleshy albumen; stem ligneous, twig-like; leaves alternate, simple, ex-stipulate.

The members of this small family are natives of Japan and North America. They contain a mucilaginous juice, devoid both of aroma and of acidity. A specimen of the scarlet-flowered schizandra (*Schizandra coccinea*) was to be seen for

corolla absent; stamens monadelphous; ovary single, unilocular; ovules one or two erect, reflexed; berry one-celled, bivalved; seed solitary, enveloped by a fleshy arillus; albumen ruminate.

The *Myristicaceæ* are trees or shrubs growing in tropical regions; their leaves are alternate, simple, entire.

The true nutmeg (*Myristica moschata*, Fig. 254) is the most celebrated member of this family; it is indigenous to the Mo-

lucos or Spice Islands, but now extensively cultivated in the tropical parts of America.

SECTION XCIII.—ANONACEÆ, OR ANONADS.

Characteristics: Sepals three; petals hypogynous, six biserial; valvate in aestivation; stamens ordinarily indefinite, multi-serial; carpels numerous, free, or almost free, containing one or more erect or ascendant ovules; fruit dry or succulent; embryo small, at the base of a ruminated albumen; stem ligneous; leaves alternate, simple, entire, without stipules.

The Anonaceæ inhabit almost every part of the torrid zone; their bark is aromatic and stimulant, sometimes acrid or nauseous. The flowers have for the most part an agreeable odour.

The Anonas produce delicious fruits. The *Anona Cherimolia*, a native of Peru, is the most celebrated. The sour sop, or *Anona muricata*, and the sweet sop, or *Anona squamosa*, (Fig. 255, 256), natives of South America and the West Indies, also are good fruit-bearers; the fruits not merely gratifying the senses of taste and smell, but pleasing the eye also on account of their elegant shape.

LESSONS IN GERMAN.—XLIII.

SECTION LXXXIX.—IDIOMATIC PHRASES (continued).

The phrase, "a friend of mine, a friend of his," etc., is rendered in German by "ein Freund von mir," a friend of me, or, einer meiner Freunde, one of my friends, etc. (§ 123. 8. d.); as:—Ein Freund von ihm segelte gestern nach Californien, a friend of his sailed yesterday for California. Einer meiner Freunde verheiratete sich vor einem Vierteljahre in Amerika, a friend of mine got married three months ago in America.

1. Auftragen, with the accusative, signifies "to put on" (as colours), or "serve up" (as food); as:—Man hat die Suppe aufgetragen, they have served up (the soup). With the dative, it means "to commission, enjoin, instruct," etc.; as:—Er hat mir aufgetragen, Ihnen zu sagen, daß er Sie morgen erwartet, he has instructed me to say that he awaits or expects you to-morrow.

2. Anrichten (literally, "to make right, or ready for") signifies "to get in readiness, to prepare" (as victuals); so, Unheil anrichten, to prepare, produce, do mischief; as:—Nachdem die Köchin die Speisen angerichtet hatte, trug sie dieselben auf, after the cook had prepared the food, she served it up. Der Geiz hat schon viel Unheil angerichtet, avarice has already produced much mischief.

3. Hinreichen, when transitive, signifies "to hand, to pass," as:—Er reichte dem Freunde das Buch hin, he handed (reached) his friend the book; when intransitive, it means "to suffice, to be sufficient," as:—Sehr wenig reicht ihn, einen klugen Menschen glücklich zu machen, very little is sufficient to make a wise man happy.

VOCABULARY.

Anrichten. (See R. 2, above.)	Donau, f. Danube.	Suppe, f. soup.
Auftragen. (See R. 1, above.)	Ertrinken, to suffer, endure, bear.	Vaterlandsfreund, m. patriot, friend of one's country.
Bestreben, to endeavour, strive, exert one's self.	Ertrinken, to drown.	Verstehen, to try, taste.
Despotisch, despotic, despotical.	Grüßen, to greet, salute.	Sinreichen. (See R. 3, above.)

RÉSUMÉ OF EXAMPLES.

Einer seiner Freunde wurde in Baden erschossen.	A friend of his was shot in Baden.
Man hat mir die Untersuchung dieser Sache aufgetragen.	They have enjoined on me the investigation of this matter.
Man trug auf, was Küche und Keller vermochte.	They served up what kitchen and cellar afforded.
Der Herr richtet nur Böses an.	Anger produces only mischief.
Es ist in Deutschland wohlfeiler leben, als in Amerika.	It is cheaper living in Germany than in America.
Es genügt mir nicht, ihn zu sehen, ich will ihn auch sprechen.	It does not satisfy (suffice) me to see him; I wish to speak to him also.

Ich will es ihm hinreichen.	I will reach it (forth) to him.
Ich wollte ihn bezahlen, aber das Geld reichte nicht hin.	I was going to pay him, but the money did not hold out (suffice).

Er arbeitet mit großem Fleiße (sehr fleißig). He labours with great industry (very industriously).
Er hat es mit Fleiß gethan. He has done it (with intention) intentionally.

EXERCISE 172.

1. Ein Vaterlandsfreund steht sicher, als daß (Sect. LX.) er zum Verräther wird. 2. Die ersten Christen erlitten sicher die härtesten Verfolgungen, als daß sie ihren Glauben verließen. 3. So etwas läßt man sich nicht zweimal sagen. 4. Einen meiner Brüder habe ich in drei Jahren nicht gesehen. 5. Ein Freund von mir ist vor einigen Jahren bei Wien in der Donau ertrunken. 6. Es ist gut reisen (Sect. XLI. 4), wenn man Geld, und gut leben, wenn man keine Sorgen hat. 7. In einem freien Lande ist besser leben, als in einem despotischen. 8. In Begleitung meiner Freunde ist es angenehmer zu reisen. 9. Nur zu leicht vergißt der Mensch im Glück, was er ist. 10. Viele ausgezeichnete und edle Männer sind vergessen worden. 11. Es darf dem Menschen nicht genügen, zu wissen was recht ist, sondern er muß sich auch bestreben, recht zu thun. 12. Es genügt mir, zu wissen, daß Ihr noch alle gesund seid. 13. Wie wenig reicht oft ein, einen Menschen glücklich zu machen. 14. Er reichte ihm die Zeitung hin, nachdem er sie selbst gelesen hatte. 15. Dieses reichte ihn, ihn zu rufen zu stellen. 16. Der Koch richtet die Speisen an. 17. Er hat diese kleine Verwirrung mit Fleiß angerichtet. 18. Die Köchin kochte (Sect. LXXXVI.) die Suppe, die sie dieselbe auftrug. 19. Man muß versuchen, ob man ihm nicht noch helfen kann. 20. Versuchen Sie einmal tiefen Wein, ob er süß genug ist. 21. Er trug mir auf, Sie von ihm zu grüßen.

EXERCISE 173.

1. I have just seen a brother of yours who has returned from India. 2. A friend of mine got married last week. 3. The teacher has enjoined on me the explanation of this subject. 4. Has my father instructed you to invite your brother to us this evening? 5. No, Sir, but he instructed me to tell my father that he might call on him to-morrow morning. 6. The scholar, upon the request of the teacher, handed the book to him. 7. Riches do not suffice to make a man happy. 8. A true Christian, rather than betray his belief, endures great suffering. 9. Is the dinner already put on the table? 10. No, Sir, it is not served up, it is not yet ready. 11. It is not sufficient for a prudent man to know what is right, but he also acts rightly.

SECTION XC.—IDIOMATIC PHRASES (continued).

Gemeßen, to enjoy, governs, as already seen (Sect. XLVI.), the genitive or accusative. It also signifies "to take nourishment, to eat or drink," in which use it governs the accusative only; as:—Ich habe heute wenig gegessen, I have eaten but little to-day.

1. Auf frequently has the force of an adjective; as:—Die Thür ist auf, the door is open, or, die Thür ist offen. 3u is similarly used; as:—Die Thür ist zu, the door is to (closed). In this use, they are frequently compounded with verbs, especially with machen; as:—Er hat das Fenster auf, und sie hat es zugemacht, he has opened the window, and she has shut it.

2. In der That (literally, "in the deed") answers to the English indeed, "in reality," as:—Ich weiß in der That nicht, was ich davon denken soll, I really do not know what to think of it. Die Freundschaft scheint mir in der That besser (Sect.), friendship appears indeed to me better.

3. Zu Stande bringen = to bring to a stand or point, that is, "to bring to pass, to accomplish," as:—Unter Wille und Ausdauer vermögen wir zu Stande zu bringen, good-will and perseverance can accomplish much.

4. Langeweile, compounded of lang, long, and Weile, while or time = tediousness, weariness, heaviness; as:—Was den Thoren vergnügt, macht dem Weisen gewöhnlich Langeweile, that which delights the fool, generally causes weariness to the wise (man). Sich langweilen = to become weary; as:—Die Rede war sehr langweilig, deswegen langweilte er sich, the discourse was very wearisome, therefore he became weary. Langweilen = to cause tediousness, to bore; as:—Er langweilte uns mit seinem Geplätz, he wearied us with his talk.

VOCABULARY.

Anrathen, to advise, counsel.	Geneßung, f. recovery, convalescence.	Rechnen, to turn, mind, care for, regard.
Ausinandergehen, to go asunder.	Gespräch, n. talk, conversation, dialogue.	Rage, f. static, condition, situation, site, seat.
Ein schlafen, to fall asleep.	Gebrauch, m. use, f. (See R. 4, above.)	Langeweile, f. (See R. 4, above.)
Geneßen, to recover.	dare, venture.	

Müdigkeit, f. weariness, fatigue.	Voran-schreiten, to proceed, progress.	Weise, m. philosopher.
Trotzen, notwithstanding.	Vorher, before, beforehand.	Zeugnis, n. witness, testimony, deposition.
Urtheil, n. judgment.	Wählen, to elect, choose.	Zufällig, accidentally, casually.
Vertraut, confidential, intimate.	Wandern, to wander, walk.	Zuhörer, m. auditor, hearer, pl. auditory.
Vielleicht, perhaps, possibly.		

RÉSUMÉ OF EXAMPLES.

Er hat während seiner Krankheit gar nichts gegessen.	During his sickness he has eaten nothing at all.
Der Knabe will ein wenig bei seinem Oheim bleiben.	The boy wishes to remain a little (while) with his uncle.
Ich habe heute zu-fälliger Weise einen alten Bekannten getroffen.	I have accidentally met an old acquaintance to-day.
Ich weiß in der That nicht, was ich thun soll.	I really (indeed) do not know what I ought to do.
Er getraut sich nicht in das Wasser zu gehen.	He does not venture into the water (to go into the water).
Haben Sie es schon zu Stande gebracht?	Have you already accomplished it?
Der Knabe schlief ein am grünen Esplanade (Schiller).	The boy fell asleep on the green shore.
Das Geplätz der Menge langweilt ihn.	The tattle (prating) of the crowd annoys (bores) him.
Er leidet an Langerweile.	He is troubled with ennui.

EXERCISE 174.

1. Der Kranke will nichts genießen, trotzdem, es ihm vom Arzte angerathen worden ist. 2. Er hat nur ganz wenig gegessen. 3. Mein Bruder ist wieder von seiner Krankheit genesen. 4. Die Geneßung schreitet bei diesem Kranken nur langsam fort. 5. Die Kirche geht um halb elf des Morgens an (Sect. LXXVIII. 6), und um halb zwölf ist sie geschlossen. 6. Er machte ihn zu seinem vertrautesten Freunde, ohne ihn vorher geprüft zu haben, oder sonst ein Zeugnis über seine Treue und Verschwiegenheit zu haben. 7. Nicht wäble zum Vertrauen einen Aker zu, das leere Haus ist offen, das reich, zu; mach' einen Aker, und suche nicht den Aker, bald wird, was Dreie wissen zu Allen mantern. 8. Kommen Sie vielleicht diesen Nachmittag ein wenig zu mir? 9. Kommen Sie vielleicht diesen Abend in das Concert? 10. Er hängt von Niemanden ab (Sect. LXXX. 1), er lebt, wie es ihm gefällt. 11. Er steht des Morgens auf, wenn es ihm gefällt, das eine Mal früh, und das andere Mal spät. 12. Er spricht und handelt, wie es ihm gefällt, ohne sich an das Urtheil der Leute zu kehren. 13. Ich habe ihn zufällig zu Hause angetroffen. 14. Zufällig traf ich ihn im Theater. 15. Es ist in der That nicht so leicht, sich in alle Lagen des Lebens gewöhnt zu machen. 16. Es ist in der That wahr, was diese Frau gesprochen hat. 17. Was sich seiner getraute, hat dieser zu Stande gebracht. 18. Er hat die Sache zu Stande gebracht. 19. Das Kind schlief aus Müdigkeit ein. 20. Die Gesellschaft langweilte sich sehr, und ging früh auseinander. 21. Er langweilte nicht nur mich, sondern auch meine Freunde.

EXERCISE 175.

1. Why have you opened the window? 2. It is so very warm in the room, and I like to enjoy the fresh air. 3. I pray you shut the window and open the door. 4. Shut the door, that the window might be open. 5. Really I do not know what to do with this son of mine; he will not listen to my advice. 6. Most of his auditors fell asleep during his long speech. 7. A good work can only be accomplished through attention. 8. My daughter's recovery proceeds but slowly. She will not eat, notwithstanding she is advised by the physician.

SECTION XCI.—IDIOMATIC PHRASES (continued).

Taugen answers to the English phrase, "to be good, or fit for," as:—Wozu taugt dieses? what is this good for? or, more literally, whereof serves this? Das taugt nichts, that is good for nothing. From this is derived the noun Taugenichts, worthless fellow; as:—Ein langer Schweiß von hochberühmten Taugenichtsen (Bieland), a long train of good-for-nothing fellows.

1. Große Augen machen (literally, "to make big eyes") is a phrase signifying "to appear surprised, or astonished."

VOCABULARY.

Anbieten, to offer, proffer, tender.	Angriff, m. attack, assault.	Darbieten, to offer.
Anführung, f. leading, conduct, command.	Batterie, f. battery.	Dragoon, m. dragoon.
	Begleiten, to pay.	Einsetzen, to enter, step in.

Er-schöpft, exhausted, spent.	Hinaus-springen, to rush out, spring out.	Un-garisch, Hungarian.
Erstürmen, to take by storm.	Kreuzer, m. a small coin.	Beweißen, to offend, to offend.
Führer, m. leader, commander.	Preussisch, Prussian.	Berzichen, to consume, eat.
Gulden, m. florin, guilden.	Türkisch, Turkish.	Berzichen, to place before, put before.
Härte, f. harshness, unkindness.	Unbilligkeit, f. unreasonableness, injustice.	Wirth, m. host, landlord, inn-keeper.

RÉSUMÉ OF EXAMPLES.

Es sind ihrer noch einmal so viele als unser.	There are twice as many of them as of us.
Ich habe ihm Geld an-geliehen.	I have offered him money.
Gold taugt nicht zu Schneidewerkzeugen, weil es zu weich ist.	Gold is not fit for edge-tools, because it is too soft.
Er machte große Augen, als er mich nach langer Trennung wieder erblickte.	He seemed surprised, as he saw me again, after (a) long separation.

EXERCISE 176.

1. Die Räuber setzten sich um ein großes Feuer, welches sie in der Mitte des Waldes angezündet hatten. 2. Er setzte sich an den Tisch. 3. Er setzte sich auf sein Pferd, und sprengte zur Stadt hinaus. 4. Die Dragoner saßen alle zu Pferde, und warteten nur noch auf ihren Führer, um den Angriff zu beginnen. 5. Er saß auf seinem Throne so fester und so leicht (Mühsam). 6. Wir trafen ihn unter einem Baume sitzend. 7. Der Gast fragte den armen (Sect. XXII. 8) Morgen den Wirth, was er schuldig sei (Sect. XLIII. 6). 8. Er hatte für das, was er verzehrt hatte, einen preussischen Thaler, oder einen Gulden fünf und vierzig Kreuzer zu bezahlen. 9. Dieser Mann ist mir hundert Thaler schuldig. 10. Nachdem er all sein Geld in der Fremde verzehrt hatte, kam er arm und entblößt in seine Heimath zurück. 11. Der Soldat verzehrte die ihm vorgesetzten Gerichte mit dem größten Appetit. 12. Sind es ihrer viele, die die Stellung verachten? 13. Ja, es sind deren viele, aber es mögen ihrer noch so viele sein, so fürchten wir uns doch nicht. 14. Es waren ihrer etwa hundert, die unter Anführung eines noch jungen Soldaten die Batterie erklärten. 15. Ein verwundeter Mensch taugt zu keiner Arbeit. 16. Dieser Beweis raunt nichts. 17. Der ungarische General hat freiwillig dem kaiserlichen Kaiser seine Dienste an. 18. Der Bauer hat dem erkrankten Patienten einige Besuche an. 19. Man sieht oft in den Zeitungen, es biete sich eine gute Gelegenheit dar, sein Glück zu machen. 20. Er beklagt sich über Unbilligkeit und Härte. 21. Du vermagst mir die Freiheit, mich bei dir beklagen zu dürfen. 22. Er wagte nicht recht, wie ihm geschah, und machte bei diesem Ereignis große Augen. 23. Er machte große Augen, als er den Freund eintreten sah, den er in beinahe zehn Jahren nicht gesehen hatte.

EXERCISE 177.

1. This knife is good for nothing; give me another. 2. What you have done is good for nothing. 3. What is a dishonest man good for? 4. These poor people ate the food that was offered them with the greatest appetite. 5. We read in every paper that Australia offers a good opportunity to make one's fortune. 6. We were astonished to see our friend, who we believed was in Germany. 7. This man owes me more than twenty pounds, but he says he has paid me. 8. I will pay you, but you cannot prove that I owe you anything. 9. Have you seen your brother to-day? 10. Yes, I saw him sitting under a tree in our garden. 11. The soldiers mounted their horses, and waited for the signal of their commander to begin the attack.

KEY TO EXERCISES IN LESSONS IN GERMAN.

EXERCISE 129 (Vol. II., page 341).

1. Vaterchen, willst du mir das Kämmchen kaufen? 2. Nein, mein Väterchen, aber ich werde dir das Kämmchen und die Nähnadeln kaufen. 3. Haben Sie jenes niedliche Häuschen gesehen? 4. Nein, ich bewundere jenes schöne Häuschen. 5. Manne freit mit dem Kämmchen, und ihr Väterchen mit dem Nähnadeln. 6. Sehen Sie, was für ein schönes Kämmchen das ist. 7. Die Menschen sollten zu jeder Zeit ihre Gedanken auf Gott richten. 8. Richten Sie es so ein, daß ich Sie morgen zu Hause finde. 9. Ich hoffe, Sie werden es so einrichten, daß Sie Montag Morgen entkommen können. 10. Was ist dieser Garten werth? 11. Er ist mehr werth als Sie glauben. 12. Was waren diese Bücher vor zehn Jahren werth? 13. Wie hoch willst du gegen dieses Pferd wetten? 14. Es gilt fünf Pfund.

LESSONS IN BOOKKEEPING.—XXIV.

(1) JOURNAL (1)									
Date.	Fol.	July, 1881.	Dr.			Cr.			
1	1	Sundries Dr.:	£	s.	d.	£	s.	d.	
	1	To Stock				32391	17	19	
	1	Union Bank	2550	0	0				
	1	Exchequer Bills	5310	0	0				
	1	Bills Receivable	7300	15	0				
	2	Three per Cents.	5400	0	0				
	2	Debentures	513	0	0				
	2	Ship Victoria, $\frac{1}{2}$ share	3000	0	0				
	2	Adventure in Scotch Linen	2467	0	0				
	2	R. O'Brien & Co.	3530	12	0				
	3	P. Hutchinson & Co.	1350	10	0				
	3	T. Brown & Co.	970	0	10				
1	1	Stock Dr.	8753	15	0				
	3	To Sundries:							
	3	To Bills Payable				2350	10	0	
	4	To Insurance				1880	15	0	
	4	To N. Herschell				1370	5	0	
	4	To J. Henderson				720	5	0	
	4	To S. Morley				960	15	0	
	4	To Schofield, Halse, & Co.				1350	10	0	
	4	To Fox, Tennant, & Co.				320	15	0	
29	5	Cash Dr.	2531	3	0				
	6	To Sundries:							
	29	To Ship Victoria				175	3	0	
	18	To Union Bank				1156	0	0	
	1	To Bills Receivable				1200	0	0	
			£ 43676	15	10	£ 43676	15	10	

(2) JOURNAL (2)									
Date.	Fol.	July, 1881.	Dr.			Cr.			
29	5	Sundries Dr.:	£	s.	d.	£	s.	d.	
	18	To Cash				2530	10	0	
	12	Union Bank	1375	0	0				
	29	Bills Payable	1145	10	0				
	8	Petty Cash	10	0	0				
	4	Insurance Dr.	25	2	3				
	4	To A. Lloyd				25	2	3	
	3	N. Herschell Dr.	6	13	0				
	3	To Sundries				5	15	6	
	3	To Insurance				0	17	6	
	3	To Commission							
	6	J. Henderson Dr.	22	16	9				
	6	To Sundries:				10	6	9	
	6	To Insurance				3	10	0	
	6	To Commission							
			£ 2585	2	0	£ 2585	2	0	
31	5	Cash Dr.	1460	8	10				
	31	To Sundries:							
	4	To Union Bank				375	0	0	
	29	To T. Brown & Co.				970	0	10	
	2	To Debentures				115	8	0	
			£ 1460	8	10	£ 1460	8	10	

(3) JOURNAL (3)									
Date.	Fol.	August, 1881.	Dr.			Cr.			
31	5	Sundries Dr.:	£	s.	d.	£	s.	d.	
	2	To Cash				1460	8	0	
	29	Fox, Tennant, & Co.	320	15	0				
	31	Union Bank	1086	0	0				
	31	Charges	41	3	0				
	25	Petty Cash	12	10	0				
	3	Sundries Dr.:							
	23	To Bills Payable				1360	0	0	
	25	R. Hastie & Co.	60	0	0				
	4	N. Herschell	1300	0	0				
		Carried forward	£ 2820	8	0	£ 2820	8	0	

(3) JOURNAL (3)									
Date.	Fol.	August, 1881.	Dr.			Cr.			
16	6	Export Goods Dr.	£	s.	d.	£	s.	d.	
	1	To Sundries:	2820	8	0	2820	8	0	
	16	To S. Morley	2889	2	3				
	16	To Tuelon & Co.				236	5	0	
	3	To W. Phillips				65	12	0	
	3	To J. Parker				535	11	5	
	16	To Matheson & Co.				42	0	0	
	10	To T. Barker				328	5	4	
	14	To R. Hastie & Co.				618	6	6	
	16	To J. Oswald & Co.				60	0	0	
	16	To W. Silver & Co.				240	0	0	
	16	To W. Smith & Co.				87	10	0	
						675	12	0	
			£ 5709	10	3	£ 5709	10	3	

(4) JOURNAL (4)									
Date.	Fol.	August, 1881.	Dr.			Cr.			
19	3	Insurance Dr.	£	s.	d.	£	s.	d.	
	5	To A. Lloyd	91	8	9				
	7	Schofield, Halse, & Co., Dr.	1444	10	0	91	8	9	
	6	To Sundries							
	6	To Export Goods				1284	18	3	
	6	To Charges				51	8	0	
	6	To Commission				74	5	0	
	3	To Insurance				33	18	9	
12	8	Richard Sykes Dr.	63	0	0				
	6	To Sundries:				60	0	0	
	6	To Export Goods				3	0	0	
	6	To Commission							
21	8	J. Roberts Dr.	2503	2	0				
	6	To Sundries:				1544	4	0	
	2	To Export Goods				808	6	0	
	6	To Adventure in Scotch Linen				21	0	0	
	6	To Charges				72	2	0	
	3	To Commission				57	10	0	
			£ 4102	0	9	£ 4102	0	9	

(5) JOURNAL (5)									
Date.	Fol.	September, 1881.	Dr.			Cr.			
30	5	Cash Dr.	£	s.	d.	£	s.	d.	
	1	To Sundries:	8425	1	6				
	30	To P. Hutchinson & Co.				152	10	0	
	8	To Union Bank				2608	0	0	
	29	To Bills Receivable				730	10	0	
	20	To Interest				75	9	0	
	21	To R. O'Brien & Co.				500	0	0	
	27	To Three per Cents.				2846	5	0	
		To Exchequer Bills				1512	7	6	
30	5	Sundries Dr.:				8425	8	11	
	29	To Cash	5812	0	0				
	25	Union Bank	162	8	11				
	8	Charges	6	1	9				
	12	Interest	236	5	0				
	15	S. Morley	32	2	0				
	17	Tuelon & Co.	278	15	11				
	17	W. Phillips	42	0	0				
	17	J. Parker	328	5	4				
	17	Matheson & Co.	367	10	0				
	29	T. Barker	995	0	0				
	20	Bills Payable	240	0	0				
	20	J. Oswald & Co.	15	0	0				
		Petty Cash							
			£ 16850	10	5	£ 16850	10	5	

(6)			JOURNAL						(6)			
			September, 1881.			Dr.			Cr.			
			£	s.	d.	£	s.	d.	£	s.	d.	
G	1	Bills Receivable Dr.	.	.	.	.	2456	15	0	.	.	.
	2	To R. O'Brien & Co.	.	.	.	.	.	.	2456	15	0	
10	4	J. Henderson Dr.	.	.	.	.	1300	0	0	.	.	.
	3	To Bills Payable	.	.	.	.	.	.	1300	0	0	
9	8	Dawson & Hancock Dr.	.	.	.	.	1750	0	0	.	.	.
	2	To Adventure in Scotch Linen	.	.	.	.	.	.	1750	0	0	
			£	5506	15	0	£	5506	15	0		
			October, 1881.									
29	5	Cash Dr.	.	.	.	.	5948	15	7	.	.	.
		To Sundries :	.	.	.	.	.	.	700	0	0	
29	1	To Union Bank	.	.	.	.	.	.	28	8	1	
3	8	To Interest	.	.	.	.	.	.	5220	7	6	
23	1	To Bills Receivable	.	.	.	.	£	5948	15	7		

HISTORIC SKETCHES.—XXXV.
THE JEWS.—I.

So intimately is the history of the Jews bound up with the Holy Scripture narrative, that few persons accustom themselves to regard the two as distinct. In one sense, of course they are not distinct. The Jewish history, like the rest of the Old Testament, was written for our learning, and is profitable for "instruction in righteousness."

It is the very groundwork, so to speak, of the Bible. Yet is it well sometimes to consider the remarkable history of this remarkable people apart from its surroundings, to learn from it the meaning of its intense individuality, and to see that had no more been patent to the world than the marvellous series of facts from the delivery out of Egypt to the establishment of Saul upon the throne, men must have been led to the conclusion that some special providence watched over the national life of the Jews, and that the Jews were a chosen people, specially favoured of the Divine Ruler of the universe. Most of the earlier Jewish history is derived from the Bible, but the later portions are drawn from many sources—from the histories of people who made a great figure in the world till they bruised themselves against the rock of Jewish nationality and were overthrown by it—from the histories of peoples who finally dispossessed the chosen people, and cast them forth as wanderers upon the face of the earth till the time of their redemption shall draw nigh. It is proposed in this and a succeeding sketch to portray the Jews as they appeared at distinct epochs in their history, with a view to directing attention to the special features of their case, and to induce our readers to pursue more closely for themselves the study of the most remarkable history known to the experience of the world.

"And all the people shouted and said, God save the king." It was a new cry in Israel. Up to that time the Jews had been content to live under the political guidance of spiritual chiefs, acting for and in behalf of that Divine Ruler who had brought them out of Egypt with a mighty hand and a stretched-out arm. Now they wearied of the unseen King who never held courts, nor entertained, nor showed himself, save in a figurative way, but who yet kept awful state in the midst of the people, being made manifest sometimes in the storm, sometimes in the whirlwind, and to those few who could understand Him in that guise, in the still, small voice. So "Samuel took a vial of oil, and poured it upon Saul's head, and kissed him, and said, Is it not because the Lord hath anointed thee to be captain over his inheritance?" and at Mizpeh Samuel collected the people and announced what he had done, reproaching them at the same time for having rejected the God "who himself saved you out of all your adversities and your tribulations," and for having said, "Nay, but set a king over us." Saul was anointed, the multitude shouted "God save the king," and the first step was taken towards divorcing the State, not from the Church merely, but from the Head of the Church, from God himself.

Those who may have noticed it as a curious thing, when reading the historical books of the Old Testament, that the functions of the prophet should have been allowed to clash with the functions of the king, and that what must often have looked like insolence was tolerated, in appearance at least, when it came from the mouth of a man of God, would do well to call to mind the peculiar relationship in which prophet and king stood to each other. Historically considered, the prophet was the creator of the king, the ruler who had governed before ever the idea of monarchical government had entered the mind of the Jewish leaders; the man who, having given, might be supposed to have some power also to take away. The prophet was the avowed oracle of God; the king was a concession to the desire of the people—a desire which was expressed in direct contravention of the will of the Almighty. The Israelitish people could not remain satisfied with a system of government which differed in so remarkable a manner from that of the nations by whom they were surrounded, and, in spite of Samuel's urgent advice, they persisted in asking for a king. Still it must be borne in mind that, in spite of this change, the principles of government which prevailed among the Israelites from the time they came out of Egypt to the period when they ceased to be a collective nation, were those of a pure theocracy—that is, of a form of government in which God is the central figure, the head from whom all orders emanate, and to whom all accounts of orders executed are rendered. As the representative of God, and the declarator of His word, a prophet was to be obeyed implicitly whenever he spoke professionally, his authority superseding even that of the king where the two conflicted. It was natural enough that the statesman on the throne should dislike, and vehemently dislike, this sort of *imperium in imperio*. So long as king and prophet agreed, which they seldom did, upon the course of government, all went smoothly, and the spiritual power came in with might to the aid of the temporal; but whenever there was a conflict, it was war to the knife. Unfortunately for the people, they were seldom on the prophet's side, inclining more frequently to take the part of the prince of this world—who, so long as they paid taxes and gave recruits for the army, allowed them to do pretty much as they pleased—rather than the part of the servant of Jehovah, who, for all that he had brought them out of Egypt, and blessed them in many things beside, was too highly exalted out of their reach for them to have sympathy with Him, and who was also of purer eyes than to behold iniquity. Instances of conflicts of this sort are many and flagrant in the course of the Old Testament Scriptures, from which it will also be seen that it was a natural tendency in the people to "start aside like a broken bow" whenever the yoke of the Divine King was laid upon them for their good. It was in consequence of this tendency that a temporal king became necessary.

Let us, before considering the constitution of the kingdom of Israel, sketch briefly the principal features of Jewish history up to the time when a king was demanded. Certain Arabs, known to us in Biblical writings as the sons of Jacob, fed their flocks and herds in the country westward of Lower Egypt, and led the nomadic life of shepherds in a land barely fruitful enough to support them. This difficulty naturally increased with the increase of population, and at times the chiefs were straitened to know what to do for food. These chiefs were non-elective heads of families, exercising despotic power over children and children's children, their authority being checked only by fear of physical resistance in their subjects. They were what Tartar or Arab chiefs are in the present day—patriarchal rulers, governing not according to any fixed law, but giving judgment according to discretion upon each case as it arose.

It so happened that about the year B.C. 1706 a drought of unusual severity forced these Arabs to look beyond their own immediate compounds for sustenance for themselves and their little ones. Many of the cattle and sheep died, and it was becoming a question of human lives also. To the neighbouring land of Egypt the eyes of the Arabs were turned; the dread of famine overcame their repugnance to mix with people alien to themselves, and some of the great chief's sons were sent down by their father to buy the necessary supplies in the fruitful land of Egypt. Egypt was the market in which they had been accustomed to sell the surplus of their own stocks. It was already known to them commercially and by repute as one of the most flourishing and richest countries in the world. Periodically it had been their practice to send down thither, and we have mention made in the Bible of some of these visits. Generally, however, they did their business through agents, merchants who came up expressly from Egypt to deal with the wanderers, and returned with their purchases in a caravan. To such dealers, a short while before the famine alluded to, the sons of Jacob sold their younger brother Joseph, against whom they had a jealousy; and from such dealers they would gladly have bought all the supplies of food they needed. But the famine was so sore in the land that the merchants would not come up into it, and those who sought produce from Egypt were therefore compelled to go down into that land and seek it there. The sons of Jacob went down, under the circumstances so familiar to readers of the Old Testament history, and found "corn in Egypt." This was sold to them by the governor of the province, who proved to be their own brother, and whose excellent behaviour and able administration had won for him the rulership over many cities, and the right of entry into the joy of his lord.

Political circumstances, which were stated at length in the Historic Sketch of Ancient Egypt (Vol. III., page 206), induced the Pharaoh who at that time reigned over Egypt to invite the Israelites to settle in that country. He knew what Joseph had done towards re-organising the kingdom, and he doubtless thought that a whole nation of such men would be a splendid leaven to mix with the elements of his own state. Besides, the Israelites were children of the desert, accustomed to rough it, and likely to shame the Egyptians out of some of the effeminacy into which they had fallen. They would also, established on the confines of the kingdom desertwards, act as a shield between the Egyptians and those marauding dwellers in the desert who afterwards overthrew the native rule in Egypt. Thus we find that, by the space of about 215 years, the Israelites, invited by the Pharaoh who was Joseph's friend, abode in the land of Egypt, and suffered all and more than the tyranny imposed upon the Egyptians by those Hyksos, or shepherd-kings, who looked upon the Israelites as traitors to the original nomadic mode of life. The history of their adversity is more familiar to us than that of their prosperity, and we know comparatively little of what they did, or of what influence they exercised in the land of their adoption. Probably their influence was less beneficial than the Pharaoh, who judged of them by what Joseph was, hoped it would be. They were in more senses than one "a peculiar people," living distinct from the rest of mankind, not likely to weld themselves in with the mass of the people, and not calculated, therefore, to perform the part of the leaven which Pharaoh had hoped for. But they were treated with a wise liberality and a uniform kindness till there arose a Pharaoh "that knew not Joseph," till the shepherd-kings had

come in from the desert and mingled Egyptian and Israelite in a common ruin. The story of their wrongs, and of the marvellous circumstances under which they were delivered from the most galling bondage, is written in the books of Moses. There, too, will be found the history of their wanderings for forty years in the wilderness. Moses, committed to positive action in behalf of his people by the homicide of the Egyptian whom he slew for insulting a Hebrew, was the man under whose guidance the Israelites were brought out of the land with a mighty hand and a stretched-out arm. The difficulties he encountered in getting permission to go, the miracles that had to be wrought—the last with so much dreadful destruction to life—before the permission was accorded, the pursuit by the King of Egypt, the overthrow of his army in the Red Sea, the entry of the Israelites into the desert beyond, and their history during the forty years before they entered the promised land, we know from the hand of Moses himself, or of one who was his companion and amanuensis. By the light of that history it is not difficult to see that the Israelites were just exactly the people not to be contented with the theocratic government which Moses established over them. Though educated enough to comprehend the folly of idol worship, and to know that disunion in the state meant political weakness, they, nevertheless, under circumstances which made it extreme sin in them, again and again committed idolatry, and conspired also to overturn the authority of him under whose sole leadership alone they were safe. In the same spirit as that of the insulting inquiry, "Who made thee a ruler over us?" the Israelites conspired against the authority of Moses, who, rigorous as he necessarily was, in the presence of facts that rendered it imperative there should be "a dictator whom all men should obey," exercised his authority with a wonderful amount of self-denial, and with a constant feeling of intense responsibility to the visible majesty of Jehovah, who was the Lord and King of the people. If we sometimes pause as we read the narrative of Moses' acts, and note that in some cases the punishment meted out by him to rebels appears to be in excess of the offence, we should remember that under circumstances like those which surrounded him cruelty is often merciful, and that he resented not any injury to himself, though he was insulted, maligned, and provoked every day of his life, but high treason to Him whose steward and servant he was. When he himself, or when Aaron was in question, he could afford to let the slanderer speak, to brook the insulting word and gesture, and to pass by in contempt the murmurings of the discontented. But when the words and deeds of rebellion were directed towards the Almighty, the zeal of God's servant knew no bounds; he called down the lightning from heaven upon the offenders, and bade the earth open and swallow them up; the quality of mercy was dried up in him; he invoked God's "wrath, anger, and displeasure" upon the people, and prayed of Him to send evil angels among them. Only when the people were humbled and cowed would he intercede for them, only when they had been persuaded by the terrors of the Lord would he consent to ask God to hold his hand.

A government like that of Moses was new to the people. They had seen priestly government, or rather the priestly ascendancy in the government, in Egypt, but there the jealousy of statesmen and the need for secular aids had prevented the complete domination of the priesthood. But a pure priesthood, reflecting the image of the heavenly King, was more than they could tolerate, if not more than they could understand. They could not bear the light which as a pillar of fire accompanied them, they resented the prying gaze of an eye which was unable to look on iniquity. Moses was the human representative of that light, of that eye; the incarnate expression of that Law-giver whose laws it was so impossible for poor human nature to obey; and therefore the rebellions against him and his authority were not many only but desperate, exhibiting a complete abandonment of all the higher and better instincts, such as might be naturally expected of those who felt they could not attain to the brilliancy of the light at the same time that they could not escape from it. The Jews seem to have been utterly unaware of the representative part they were destined to play in the history of the world, and to have looked only to present ease or advantage in framing their rules of conduct. They walked by sight and not at all by faith, and they stumbled at every turn.

GEOMETRICAL PERSPECTIVE.—X.

PROBLEM XXIX. (Fig. 51).—A cube 4 feet side has one of its faces at an angle of 50° with the PP, its nearest edge touches the picture plane 1 foot to the left of the eye; height of eye 5 feet; distance from the PP 8 feet; scale 1 inch to the foot.

It will be seen that as the nearest angle touches the PP, it will commence at b , 1 foot to the left of a ; and because b is a point of contact, its height, bc , may be measured from b ; bd is equal to the edge of the cube, 4 feet; its perspective length, bm , is cut off the vanishing line bvp^2 by its distance point dvp^2 . The other face of the cube must be treated in the same way; it vanishes at vp^1 , therefore the line from e to cut off the perspective length bn must be drawn to dvp^1 ; the lines of the horizontal and upper face of the cube will be ruled to their respective vanishing points, as in Fig. 33, Lesson V., Vol. III., page 9.

PROBLEM XXX. (Fig. 52).—Draw by this method the flight of steps given in Lesson VIII., page 203. There are three, each 4 feet long, 1 foot wide, and 9 inches high; their front making an angle of 40° with the picture plane. The distance of the eye of the observer from the picture plane is 6 feet; from the plane to the nearest point of the object 1 foot; the height of the eye 4.5 feet; scale 1 inch to the foot.

We will merely go through the order of procedure, until we come to something especially suggested by this problem. Draw the PP; the HL; place the station point, marked E ; draw the line from E to find the vp^1 for the angle of inclination of the face with the PP. As the base of the object forms a right angle, the line zvp^2 must be drawn at a right angle with zvp^1 for the VP of the ends of the steps. Produce zrs to the PP at a ; the nearest point within is 1 foot; make $a b$ equal 1 foot, and a line from b drawn to DE will cut rs at c , the nearest point within; draw lines from c to each VP, and find their distance points. A line from dvp^2 must be drawn through c to the PP at e ; the widths of the steps will be marked off at f, g, h . Produce vp^2c to the PP at m , draw the perpendicular $m n$ for a measuring line, and upon it mark off the heights of the three

steps, o, p, n ; rule from these points to vp^2 . From the widths of the steps e, f, g, h , draw lines towards dvp^2 , stopping at the vanishing line from c , from which perpendicular lines, made to cut the retiring lines from $o p n$, will give the respective ends and heights of the steps; from the angles of the steps draw lines towards vp^1 . To cut off the lengths of the steps upon the vanishing line $c vp^1$, draw the line $c v$, directed by dvp^1 ; make vw equal to 4 feet, the length of the steps; from w draw back again towards dvp^1 , cutting the vanishing line from c in k ; draw from k to r , directed by vp^2 , from r raise another measuring line for the opposite ends of the steps. Make st equal to $o p n$, draw lines from them to vp^2 ; these last lines, intersecting the retiring lines from the tops of the steps, will give the further ends. These slight directions will be quite sufficient for the guidance of those who have thoroughly studied Problem XXVII.

One of the greatest difficulties in geometrical perspective is the treatment of inclined lines and planes. The plan method we have already given is, no doubt, as useful as any, but in some cases the method we are about to explain in this lesson will be found easier and more satisfactory. If the pupil will turn back to Lesson VI., Problem XVIII., Fig. 37, page 72, he will there be reminded how the perspective of an inclined line or plane is obtained by the help of orthographic projection; that is, from a given position of the inclined plane, to produce its plan and elevation, and afterwards from both produce the perspective projection. We

now propose to draw the perspective of inclinations without previously constructing a plan. We must start once more from one of the leading principles of perspective belonging to every system, and which is well known to our pupils—that all horizontal retiring lines and planes have their vanishing points upon the line of sight; to this must now be added: directly a line or a plane ceases to be horizontal, having one of its ends raised or lowered, its vanishing point is raised or lowered also, for, notwithstanding its inclination, it retires, and has a vanishing point; therefore the vanishing point of an inclined line or plane is perpendicularly above the point to

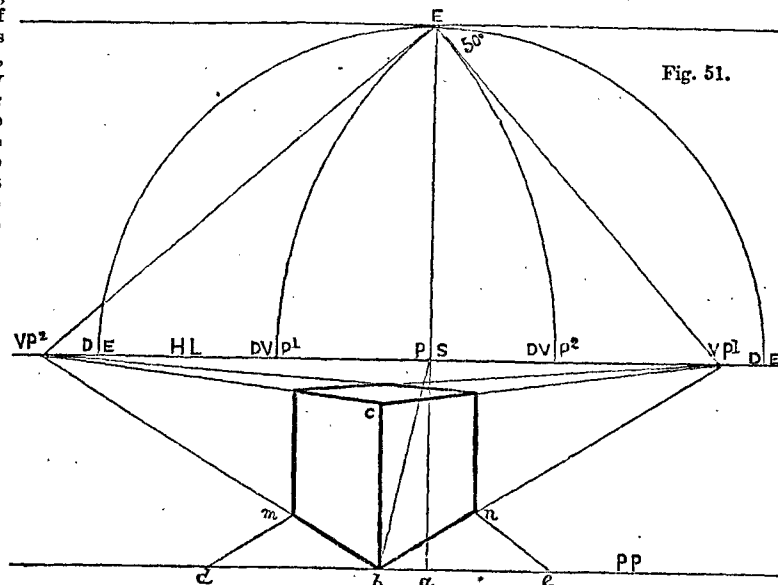


Fig. 51.

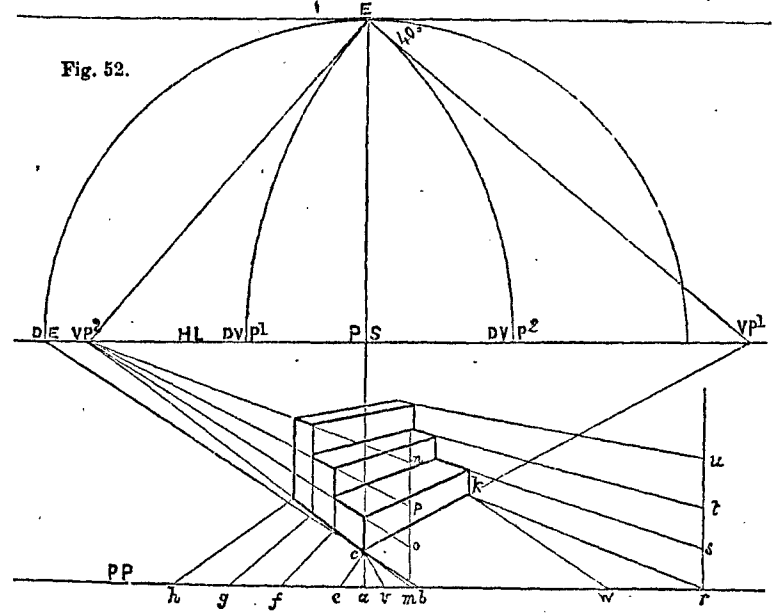


Fig. 52.

which it retired before it was raised out of its horizontal position—in other words, the position of the new vanishing point is according to the angle of the inclination of the line or plane; this brings us to our object, to show where to find the VP, by constructing the angle.

PROBLEM XXXI. (Fig. 53).—Give the perspective representation of a pole inclined to the ground at an angle of 30° . The plan of the pole is at an angle of 50° with the PP. Length of pole 6 feet; the end on the ground is 2 feet within the picture. The distance of the eye from the PP 8 feet; its height from the ground 4 feet. First draw the HL, and upon it, from the rs as a centre, draw the semicircle with a radius equal to the distance of the eye from the PP; raise a perpendicular line from rs to E , and through E tangential to the semicircle draw a line parallel to the HL. From E draw a line (zvp^1) at an angle of 50° with the tangential line. Draw the nr (base of the picture) parallel to the HL at a distance of 4 feet. Draw $rs c$, and make cd equal to 2 feet; draw a line from d to DE , cutting $rs c$ in a ; this will give the point where the pole rests upon the ground. Now if the pole were in a horizontal position, its vanishing point would be at the VP on the HL, but being inclined, its true vanishing point is above it (if the inclination had been downwards, its vanishing point would have been below the HL). Therefore through the VP on the HL draw an indefinite perpendicular line; find the distance point of the VP by drawing the arc $E dvp^2$ from VP as a centre, and with the radius $VP E$. From dvp^2 draw a line at an angle of 30° , meeting the perpendicular from VP in vp^2 ; the vp^2 will be the vanishing point for the inclined line. Through the point a draw a line directed to VP and meeting the nr in f (the point of contact); from f draw the perpendicular $fg h$ (the line of contact). Again, the pupil must be reminded of a rule we gave in our last lesson, that every vanishing line must be cut from its own distance point. Now the vanishing line in this case is of the pole only from a to vp^2 , and upon this line we must cut off a portion

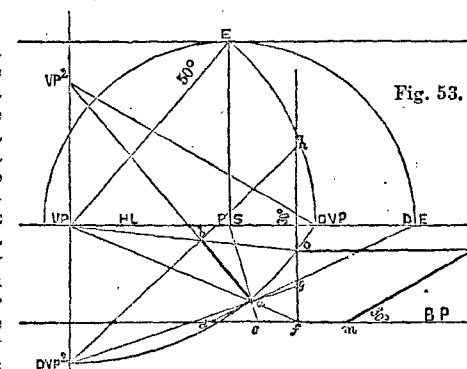


Fig. 53.

the pole as previously found in b . This is one of the problems we recommend our pupils to repeat several times, placing the pole at other angles, and turning it the other way in the picture. A thorough knowledge of the practice of cutting vanishing lines from their distance points is the key-stone of the principle contained in this method of representing objects in perspective. We purpose now to show how this may

be applied to give the inclination of a roof, and as it will be necessary to draw the whole figure we will give out the whole problem, and advise that it should be done on a larger scale: our diagram is drawn to a scale of 60 feet to the inch to economise space; it should be drawn by our pupils on a scale of about 10 or 12 feet to the inch.

PROBLEM XXXII. (Fig. 54).—Draw the perspective view of a square tower having wings: the bases of the tower and the wings are each a square of 48 feet side; height of tower 96 feet, and of the walls of the wings 48 feet; the inclination of the roof 30° , HL 10 feet, nearest end 12 feet within the PP; distance of the eye from the PP, 120 feet; angle of the front of the building with the PP, 50° .

Having repeated in the last problem the process which was explained in the last lesson, of finding the rs , E , and HL , the vanishing points and their distance points, we will commence by finding the position of the nearest corner of the building. Draw from rs to a ; make ab equal 12 feet; draw from b to DE , the intersection will give the point required, from which a line must be drawn to vp^1 . The next part of the process is the stambling-point of most beginners in this branch of perspective, and we therefore request their attention to it. Find the distance point of vp^1 , viz., dvp^1 . From dvp^1 draw a line through the nearest corner already found to the BP at e ; measure from e to f , from f to g , and from g to h , each distance equal to the lengths of the bases of the wings and tower; rule from these points back again to dvp^1 , we shall then have cut the several proportions of the front of the building off the vanishing line—that is, from the

nearest angle below c to vp^2 —by the help of the distance point of vp^1 . We make no excuse for repeating this, because we know from practical experience how often this is forgotten. The end of the building must be treated in the same way, beginning with a line from

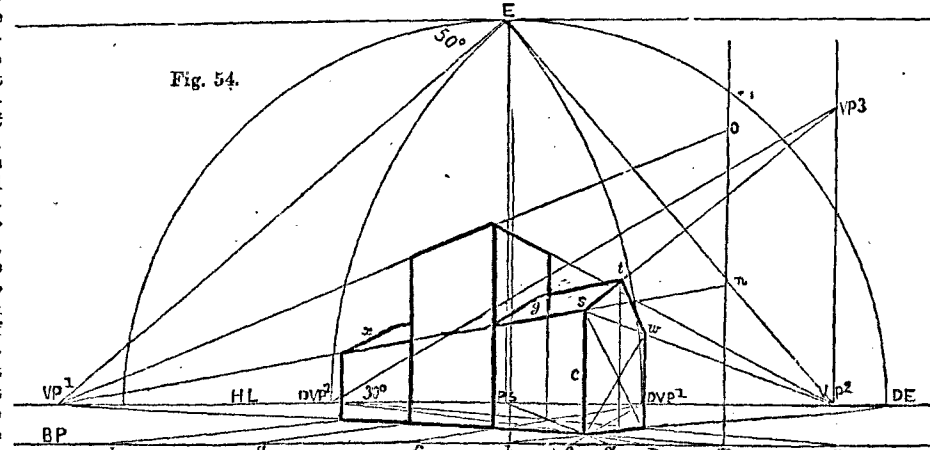


Fig. 54.

a line from dvp^2 , through a , to the line of contact at g ; mark off gh equal to the length of the pole, 6 feet; and from h draw a line back again to dvp^2 , cutting the vanishing line of the pole in b ; ab will be the required perspective representation of the pole. To prove this, draw anywhere upon nr the line $m n$, 6 feet long, and at an angle of 30° ; the pupil will see that this is the full length of the pole at the given angle, consequently its height from the ground at n is shown; draw $n o$ parallel to HL —in other words, mark the height of the pole from the ground upon the line of contact; draw a line from o to the VP, it will be found to cut the top of

dvp^2 to p ; $p r$ is the width of the building; vp^2 its vanishing point; the heights on the line of contact are at n and o . We presume there will be no difficulty with the rest of the perpendicular and horizontal lines, and we now proceed with the roof. Because the ridge of the roof is over the centre of the body of the building, there is no necessity in this case for finding more than one vanishing point for the roof, viz., the inclination st . The vanishing point for that inclination is vp^3 on the perpendicular from vp^2 , found by making an angle of 30° from dvp^2 . The centre of the building is found by drawing the diagonals at the end and a perpendicular through their intersec-

tion to t ; join t to w , and we have the other or downward side of the roof; the lines x and y of the roof (in the building itself) are parallel to st , and have the same VP, namely, VP³.

Our next problems will have especial reference to two inclinations, and will require very close attention.

READINGS IN FRENCH.—XI.

F E D O R A .

SECTION III.

"Je suis," dit-il, "un commerçant de Moscou; j'avais entrepris (a) un voyage à Varsovie. Avant de m'éloigner (b); j'ai voulu aller visiter un gentilhomme que je connais, et qui demeure à quelque distance; armé d'un fusil, je me suis rendu à pied à son château, où je me suis arrêté. La neige tombait à gros flocons, je me suis (c) égaré; je cherchais en vain ma route, quand je vis venir à moi deux hommes à qui je m'empressai de demander quelques renseignements. Je n'avais aucune défiance, et j'attendais tranquillement leur réponse, quand tout à coup ces deux scélérats, se précipitant sur moi, me terrassèrent et me dépouillèrent du peu d'argent que j'avais. Je poussai un cri; c'est alors que l'un d'eux tira sur moi un coup de pistolet, car ils voulaient me tuer."

Pendant le récit de l'étranger, Fedora avait eu l'œil constamment fixé sur lui. Il (d) lui semblait retrouver sur son visage des traits connus, sans se rappeler où elle l'avait vu; toutefois, son cœur battait avec violence, un sentiment irrésistible l'attirait vers lui. Polowski pria son hôte de lui donner quelques détails sur l'incendie de Moscou.

L'étranger parut éprouver quelque répugnance à satisfaire à cette demande; néanmoins, en réfléchissant au service qu'il avait reçu, il n'osa (e) refuser. En décrivant le triste spectacle de ce vaste incendie, sa voix trahissait de vives émotions. Mais quand il commença à raconter ses propres malheurs, il versa des larmes abondantes; et poussant un profond soupir, il dit:—

"Hélas! ce terrible incendie ne m'a pas seulement enlevé une grande partie de ma fortune, mais encore ce qui faisait (f) tout notre bonheur, ma fille bien-aimée. Tandis qu'au milieu du désordre affreux excité par l'épouvantable catastrophe, nous cherchions, ma femme et moi, à soustraire à la voracité des flammes nos objets les plus précieux, nous perdîmes notre enfant, alors dans sa sixième année; sa bonne l'avait prise avec elle afin de la conduire dans la maison d'un ami qui demeurait dans une rue écartée, où le feu ne sévissait pas encore. Mais ni la bonne ni l'enfant n'ont reparu, et depuis cet événement, toutes nos informations ont été stériles. Probablement, quelque édifice, en croulant, les aura englouties sous ses débris."

A ces mots Fedora, qui avait écouté avidement toutes les particularités de ce récit, ne put (g) contenir davantage les émotions qu'il avait éprouvées en elle. Elle se précipita au cou de l'étranger, en s'écriant:—

"O mon père! mon père!"

Ce fut un spectacle touchant. On nous pardonnera de ne point chercher à peindre la joie et la félicité dont leurs cœurs étaient inondés. La plume est impuissante en face de tels tableaux. Que nos jeunes lecteurs se mettent à la place de Fedora ainsi que de son père.

COLLOQUIAL EXERCISE.

- Comment le Moscovite commença-t-il son récit?
- Qui avait-il voulu visiter?
- De quelle manière s'était-il rendu au château du gentilhomme?
- S'était-il égaré?
- Que vit-il venir vers lui?
- Que firent les deux hommes?
- Que fit l'un des voleurs après que le commerçant eut poussé un cri?
- Fedora était-elle attentive au récit de l'étranger?
- Paraissait-elle (h) le reconnaître?
- Quel sentiment éprouvait-elle en l'entendant?
- Quelle demande Polowski fit-il à son hôte?
- L'étranger parut-il (i) satisfaire volontiers à cette demande?
- Paraissait-il ému durant son récit?
- Que fit-il en racontant ses malheurs?
- Que lui avait enlevé l'incendie?
- Que faisaient lui et sa femme au milieu du désordre?
- Où avaient-ils envoyé leur petite fille?
- Avait-elle revu (j) depuis, la bonne et l'enfant?
- Que fit Fedora en entendant ce récit?
- Pourquoi l'auteur ne décrit-il pas ce qui se passa entre le père et la fille?

NOTES.

- | | |
|---|----------------------------|
| (a) From <i>entreprendre</i> . | (e) N'osa, dared not. |
| (b) M'éloigner, leaving the neighborhood. | (f) From <i>faire</i> . |
| (c) Je me suis égaré, I lost my way. | (g) From <i>pouvoir</i> . |
| (d) The it is unipersonal; it. | (h) From <i>paraître</i> . |
| | (i) From the same verb. |
| | (j) From <i>voir</i> . |

SECTION IV.

Après les premiers épanchements, Fedora raconta à son tour l'espèce de succession de miracles auxquels elle devait (a) son salut. La bonne vivandière ne fut point oubliée dans ce récit: mais avec quelle sensibilité, quelle touchante expression de reconnaissance, elle exposa tout ce qu'elle devait à la bienveillance du seigneur polonais qui l'avait recueillie et traitée (b) comme son enfant.

Au bout de quelques jours, la blessure du père de Fedora était guérie. Il dut (c) quitter le château de Polowski, et Fedora le suivit, non sans assurer à ses bienfaiteurs que sa reconnaissance ne s'éteindrait qu'avec sa vie.

Ils revinrent (d) à Moscou, où leur retour causa une joyeuse surprise. L'histoire de Fedora se répandit (e). Un jeune seigneur russe, qui occupait un haut grade dans les rangs de l'armée, demanda la jeune fille en mariage et l'épousa.

Dix ans s'étaient écoulés. La Pologne avait proclamé son indépendance, et l'empereur de toutes les Russies, Nicolas, mit une armée en campagne pour comprimer les efforts de cette héroïque nation. On sait (f) l'issue de cette lutte inégale. L'époux de Fedora avait pris part à la campagne; Fedora l'avait suivi. Sans nous arrêter à rappeler les scènes déchirantes de cette guerre, nous dirons seulement que Varsovie venait d'être emportée d'assaut. Dans ce jour néfaste, des milliers de Polonais et de Russes périrent. Vers le soir, tous les officiers supérieurs de l'armée triomphante allèrent visiter le champ de bataille, où gisaient (g) pêle-mêle les cadavres des vainqueurs et des vaincus.

Là, gémissaient confondus parmi les morts, un nombre infini de blessés. Poussé par la charité, ému de compassion pour le destin de ceux à qui la fortune avait été contraire, l'époux de Fedora fit transporter dans les hôpitaux et les ambulances, ceux à qui il restait encore un souffle de vie. Après ces soins pieux, il allait s'éloigner de ce lieu de désolation, lorsque parmi plusieurs cadavres qu'on allait recouvrir de terre, il aperçut un officier polonais de haut rang et tout chamarré de croix et de décorations. Il crut remarquer en lui quelques signes de vie, et le fit transporter dans la maison même où était Fedora. Là tous les soins nécessaires lui furent prodigués; et, peu à peu, sortant de sa léthargie, l'officier polonais rouvrit les yeux.

Fedora était assise (h) au chevet de son lit. Tout à coup elle poussa un cri, elle avait reconnu Polowski.

Polowski, rétabli de ses blessures, n'avait échappé à un péril, que pour retomber dans un danger plus terrible encore. Son nom fut porté sur la liste des proscrits. Quand Fedora l'apprit, elle se rendit immédiatement près de l'empereur; elle embrassa ses genoux, et demanda sa grâce, et Nicolas attendri, prononça le pardon de Polowski.

COLLOQUIAL EXERCISE.

- Que raconta Fedora?
- Parla-t-elle de la vivandière?
- De quelle manière parla-t-elle des bienfaits de Polowski?
- Le père de Fedora fut-il longtemps malade?
- Partit-il bientôt?
- Que fit Fedora à son départ?
- Où allèrent le négociant et sa fille?
- Qui épousa Fedora?
- Que se passait-il dix ans plus tard?
- Que fit l'empereur Nicolas?
- Où était l'époux de Fedora?
- Qu'était-il arrivé à Varsovie?
- Qu'arriva-t-il dans ce jour fatal?
- Que firent les officiers supérieurs?
- Que voyait-on sur le champ de bataille?
- Que fit l'époux de Fedora?
- Qu'aperçut-il parmi les cadavres?
- Que crut-il voir en lui?
- Que fit-il du pauvre blessé?
- Comment fut-il traité dans la demeure de Fedora?
- Où était Fedora, et que fit-elle?
- Polowski était-il en sûreté après sa guérison?
- Quel nouveau danger le menaçait alors?
- Que fit alors sa fille adoptive?

NOTES.

- | | |
|---------------------------|---|
| (a) From <i>dévoir</i> . | (e) Se répandit, became known. |
| (b) Traitée, cared for. | (f) From <i>savoir</i> . |
| (c) From <i>dévoir</i> . | (g) From <i>dévoir</i> . |
| (d) From <i>revenir</i> . | (h) Assise, seated; from <i>asseoir</i> . |

KEY TO EXERCISES IN LESSONS IN FRENCH.

EXERCISE 163 (Vol. II., page 331).

- Do you fulfil your duty well? 2. Neither of us fulfils it. 3. Do they both seek to expose themselves? 4. No, they seek to expose their lives. 5. Do your father and mother find themselves better to-day? 6. Neither of them is better. 7. Have you found fault with my writing or with my secretary's? 8. I have found fault with neither. 9. Does not that author find fault with everything? 10. He finds fault with every book. 11. Do you find anything to blame in it? 12. Neither he nor I find anything to blame (censure) in it. 13. He or I will watch over your interests. 14. Neither he nor I shall cease watching over your son's conduct. 15. We will watch over it, rather than find fault with it. 16. He and I found ourselves together at the appointed place. 17. Will either of you be there (be present) then? 18. One or the other will be present. 19. Will either be elected president? 20. Neither will be elected. 21. How do you like this roast meat? 22. I find it excellent. 23. I like this book (I find this book good). 24. I do not like it (I do not find it good). 25. I find that well done (I deem that well done).

EXERCISE 164 (Vol. II., page 331).

- Comment trouvez-vous ce livre? 2. Ni ma sœur ni moi ne l'aimons. 3. MM. vos frères ont-ils trouvé le diner bon? 4. L'un et l'autre l'ont trouvé très bon. 5. Le professeur a-t-il trouvé à redire à votre conduite? 6. Il n'y a pas trouvé à redire. 7. Ni lui ni mon père ne trouvent à redire à ma conduite. 8. Veillent-ils à votre conduite, l'un et l'autre? 9. Ils veillent l'un et l'autre, à ma conduite et à mes intérêts. 10. Avez-vous rempli votre devoir, l'un et l'autre? 11. Nous l'avons rempli. 12. N'avez-vous pas, l'un et l'autre, trouvé à redire à mon écriture? 13. Ni l'un ni l'autre, nous n'y avons trouvé à redire. 14. Milles vos sœurs, ne se trouvent-elles pas mieux aujourd'hui? 15. L'une se trouve mieux. 16. L'autre ne se trouve pas si bien. 17. Ces dames ne trouvent-elles pas à redire à tout? 18. Elles ne trouvent à redire à rien. 19. L'un ou l'autre sera-t-il élu préfet du département? 20. Ni l'un ni l'autre ne sera élu. 21. Comment trouvez-vous ce pain? 22. Je le trouve fort bon. 23. Vos deux amis sont-ils arrivés à temps au rendez-vous? 24. Ni l'un ni l'autre n'y étaient à temps. 25. Trouvez-vous à redire à cela? 26. Je n'y trouve pas à redire. 27. Vous exposerez-vous, l'un et l'autre, à ce danger? 28. Nous ne nous y exposerons pas. 29. Trouvez-vous à redire à la conduite de mon secrétaire? 30. Je n'y trouve pas à redire. 31. Trouvez-vous à redire à son écriture? 32. J'y trouve à redire; car elle est très mauvaise. 33. Ne veillerez-vous pas à mes intérêts? 34. Mon frère et moi, nous y veillerons. 35. Nous ne cesserons pas de veiller à vos intérêts.

EXERCISE 165 (Vol. II., page 331).

- Did not most of your relations come to see you? 2. Many came. 3. What has become of the others? 4. I could not tell you what has become of them. 5. What will become of that young man if he does not apply to study? 6. I do not know what will become of him. 7. I know that he will never become learned. 8. How many pictures have you left? 9. I have only one picture left. 10. How much shall you have left, when you have made your purchases? 11. I shall only have a trifle left. 12. Has that apprentice become skilful in his trade? 13. He has become skilful in it. 14. Was that gentleman born blind, or has he become so? 15. He has become so. 16. Do you know what has become of those young men? 17. They have become physicians. 18. Do you not know what has become of my books? 19. They are mislaid. 20. Will you not become lame, if you walk so much? 21. I shall become lame and thin. 22. Did not the crowd lose their way in the wood? 23. The crowd lost their way in it, and could not find it again. 24. A crowd of barbarians desolated the country. 25. A crowd of ruined citizens filled the streets of Stockholm.

EXERCISE 166 (Vol. II., page 331).

- La plupart de vos amis ne sont-ils pas devenus riches? 2. La plupart (de mes amis) sont devenus pauvres. 3. Cette demoiselle n'est-elle pas devenue savante? 4. Je pense qu'elle ne deviendra jamais savante. 5. L'armée américaine n'est-elle pas fort petite? 6. L'armée américaine est petite, mais la plupart des soldats américains sont très braves. 7. Pouvez-vous me dire ce qu'est devenu ce monsieur? 8. Je ne saurais vous dire ce qu'il est devenu. 9. M. votre frère est-il aveugle de naissance? 10. Non, Monsieur, il l'est devenu. 11. Êtes-vous né boiteux? 12. Non, Monsieur, je le suis devenu il y a trois ans. 13. La plupart de vos heures ne sont-elles pas dévouées au jeu? 14. Non, Monsieur, elles sont dévouées à l'étude. 15. Combien de votre argent vous resta-t-il? 16. Il ne m'en reste que vingt-cinq francs. 17. Savez-vous combien il me reste? 18. Il ne vous reste qu'une bagatelle. 19. Combien vous restera-t-il demain? 20. Il ne vous restera que six francs. 21. Il ne vous restera que deux francs, quand j'aurai fait mes emplettes. 22. Qu'est devenue votre gram-maire? 23. Je l'ai égarée. 24. Savez-vous ce qu'est devenu mon chapeau? 25. Vous l'avez laissé sur la table. 26. Ce monsieur ne deviendra-t-il pas aveugle? 27. Il ne deviendra pas aveugle, mais boiteux. 28. Votre fils est-il devenu habile dans son état? 29. Il n'y

est pas devenu habile. 30. Qu'est-il devenu? 31. Il s'est égaré dans le bois. 32. La foule s'est-elle égarée? 33. La plupart des soldats se sont égarés. 34. Une nuée de sauterelles désolèrent notre pays.

MECHANICS.—X.

THE STEELYARD.

ANOTHER weighing instrument is the steelyard, which (Fig. 54) is a lever of the first order, to the short arm of which is attached at b a hook from which the substance, w , to be weighed is suspended, while on the long arm slides the movable counterpoise p . The object aimed at in this instrument being that a small weight, p , should balance a large one, w , on the hook, it is clear that there must be a corresponding disproportion in the arms—the fulcrum, a , must be near one of the ends of the beam. Further, since it is necessary that the steelyard should take an horizontal position, both when loaded and unloaded at its hook, it is essential that its own centre of gravity should lie somewhere on the short arm; for then the counterpoise can balance it when placed in some position on the other arm, such as at o . For this reason steelyards are made heavy at one end.

To Graduate a Steelyard.—The centre of gravity of the beam being on the hook side of the fulcrum, let it be brought into an

horizontal position, no weight being on the hook. Then, as proved in previous lessons, the moment of p is equal to the moment of the beam, that is, the weight of the beam multiplied into the distance of its centre of gravity from a vertical line through the fulcrum, is equal to p multiplied into the distance

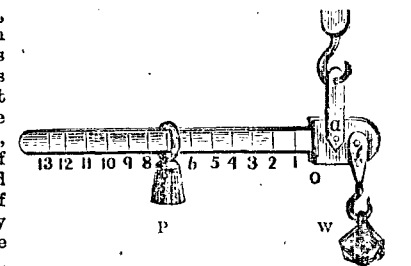


Fig. 54.

of o from that line. At the point o so found draw a line across the beam; that line represents the zero division of the long arm, or the division at which p produces equilibrium, the weight on the hook being nothing, cipher, or zero.

Now, supposing that any number of pounds, w , of any substance are hung on the hook, while p is shifted to the left until, as in the figure, the arm is again horizontal, we have p multiplied by the distance of its ring from the fulcrum a equal to w multiplied by $a b$ (this line $a b$ being supposed horizontal), together with the moment of the beam. But p multiplied by the distance of the zero division from a , is equal to the moment of the beam, as already proved; therefore it follows that p multiplied by its distance from the zero division is equal to w multiplied by $a b$. Now, in order to graduate, let us suppose p one pound and w seven. Then we have in numbers seven times $a b$ equal once the distance of the counterpoise from o , which tells us the exact position of p for 7 pounds on the hook, namely, that you find it by measuring from o to the left seven pieces each equal to $a b$. Let w be 13 pounds or 3 pounds, then in like manner you measure 13 or 3 pieces equal to $a b$. It thus appears that the subdivisions for the successive pounds are equal to each other; and we may therefore lay down the following rule for graduating a steelyard:—

Find first the zero subdivision by bringing the unloaded instrument into an horizontal position by the counterpoise. Put then on the hook, or in the pan, such a number of even pounds as will push the counterpoise to the greatest distance it can go on its arm for even pounds, and divide the distance between this last position and the zero point into as many equal parts as there are then pounds on the hook. The points of division so obtained are the positions of the counterpoise for the several pounds up to that number.

For half and quarter pounds these divisions must be subdivided; and for greater weights than one pound will balance on the long arm, the counterpoise must be doubled or trebled, etc. If the steelyard be intended for weighing small objects, such as letters, the counterpoise may be ounces, or tenths of an ounce, or even smaller weights, as occasion requires. *

THE DANISH BALANCE.

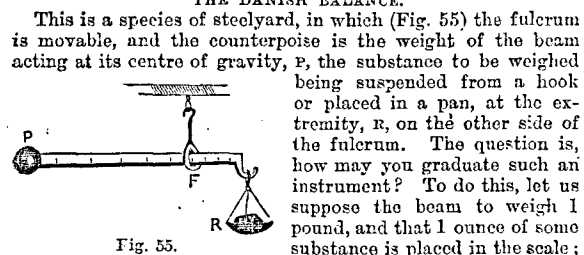


Fig. 55.

F, must be shifted to the point in which FR is to FP in the proportion of 16 to 1, there being 16 ounces in the pound. This comes to dividing the distance RP (which is known) into seventeen equal parts, as proved in Lesson IV., and taking the first point of division next to P for the fulcrum. If there be 2 ounces in the pan, RF must be to FP as 16 to 2; that is, you divide RP into 18 parts, and take the fulcrum 2 from P . If there be 7 ounces, you divide into 23 parts, and take 7 next to P ; and so on for all the ounces from 1 to 16 you may determine the several positions of the fulcrum, marking them as you proceed. If the beam be of any other weight, you follow a similar course, dividing RP into as many equal parts as there are ounces in the sum of the weights of the beam and substance, and counting off as many divisions from P as there are ounces in the latter.

From all this it is evident, first, that the subdivisions are not equal to each other, as in the steelyard; secondly, that the operation of graduation is more troublesome than in that instrument. The Danish balance, however, has the advantage of not being encumbered with a movable counterpoise; it carries its own imperial standard weight within itself.

THE BENT LEVER BALANCE.

The principle of this instrument, a species of which is largely sold for weighing letters, may be understood by the aid of the accompanying Fig. 56. On an upright stand is placed a quadrant arc, RO , of which O is the centre. Round O as a fulcrum revolves a lever, usually bent, but in the figure represented as formed of two arms at right angles to each other. The arm CB is generally of small weight, being lightly constructed, while the other, OC , called the "index arm," is heavily weighted at its lower end, the centre of gravity of the whole lever thus being nearly at some point, Q , on that arm.

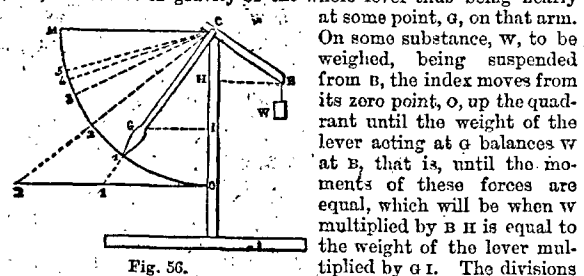


Fig. 56.

On some substance, w , to be weighed, being suspended from B , the index moves from its zero point, O , up the quadrant until the weight of the lever acting at Q balances w at B , that is, until the moments of these forces are equal, which will be when w multiplied by BH is equal to the weight of the lever multiplied by QI . The divisions of the quadrant corresponding to the several weights 1, 2, 3, 4, etc., suspended from B arc, however, best determined by experiment for each weight.

THE LEVER WHEN THE FORCES ARE NOT PARALLEL.

In all the cases of levers and weighing instruments we have so far considered, the forces were supposed parallel—in weighing instruments necessarily so. The treatment of the subject is, however, not complete until the condition of equilibrium is determined for levers the forces acting on which are not parallel. This is the most general case that can occur, and indeed it includes all the others. To clearly understand it, let a lever be defined a mass of matter of any shape which has one fixed point in it. It may be a bar straight, or simply bent, or bent and twisted, or it may be a solid block. So long as there is one point fixed, we may treat it as a lever, that point being the fulcrum.

Moreover, the two forces which act on it are supposed to be such that their directions when produced meet, and that their

plane passes through the fulcrum. In cases where the two forces do not meet, or their plane does not pass through the fulcrum, there cannot be equilibrium. For example, the outstretched right arm of a man is a lever, of which the fulcrum is in the right shoulder. Suppose, as he stretches it before him in a horizontal position, one force is applied to the hand obliquely from him towards the left to the ground, while another acts horizontally at his elbow towards the right and at right angles to the arm; these forces cannot meet, and therefore would not under any circumstances keep the arm in equilibrium; further, even were they to meet, they would not so keep it unless their plane passed through the fulcrum in the shoulder socket. Supposing the forces, therefore, to be as described, namely, that their directions meet and their plane passes through the fulcrum, what is the condition of equilibrium? In order that you may clearly understand this, the knowledge of the following geometrical principles is necessary.

FURTHER PROPERTIES OF A PARALLELOGRAM AND TRIANGLE.

1. The area of a triangle is half that of any parallelogram which has its base for one side, and a line drawn through its vertex parallel to that base for the side opposite.—This appears from Fig. 57, where AVB is the triangle, and $ABCD$ any parallelogram on AB formed by drawing from A and B any two parallel lines AD , BC to meet the parallel DC to AB through V . For, draw VE parallel to AD , and therefore parallel to BC , to meet AB in E . Then the triangle AVD is made up of the two triangles AVE and BVE . But since $AEVD$ is a parallelogram, the triangle AVE (Lesson III.) is equal to ADV , and is therefore half the parallelogram $AEVD$. So likewise is BVE half $BEVC$; and therefore the triangle AVB half $ABCD$.

2. The area of a triangle is, in numbers, half the product of its base and the perpendicular from its vertex on that base.—This follows from the previous principle. Let the number of inches or feet, say inches, in AB (Fig. 58) be 6, and in the perpendicular, VE , be 7, and construct on AB a parallelogram, $ABCD$, whose sides are parallel to this perpendicular. Such a parallelogram is termed a "rectangle," on account of its angles being all right angles. Mark out the inches on AB and VE , and draw the dotted lines in the figure parallel to AB and VE , cutting this rectangle into the smaller ones the sides of which are all equal to one inch, and which are therefore so many square inches. Now there are seven rows of these squares, one row above the other, and there are six squares in each row; and therefore there are altogether 7 times 6, or 42, square inches in the rectangle. But the triangle being half the rectangle, is half of 42 square inches, that is, it is, in numbers, half the product of the base and perpendicular. Were the numbers 13 and 9, or any other pair whatever, the reasoning would be the same.

3. If two triangles stand on opposite sides of a common base, and the line joining their vertices is bisected by that base, the triangles have equal areas.—In Fig. 59, the triangles ABC , ABD stand on the common base, AB , at opposite sides, and DC joining their vertices is supposed to be bisected at S ; I have to prove that the areas of the triangles are equal. Draw EF and HG through A and B parallel to DC , and also through D and C draw HE and GF parallel to AB . Then we have a large parallelogram $EFHG$, which is divided into four smaller ones by AB and DC . But since DC is bisected at S , making MS equal to SD , and therefore AE equal to AF , the parallelograms $AFGB$ and $AHEB$ are equal to each other. But, as proved above, the triangles ABC and ABD are half of these parallelograms, and therefore are also equal to each other, as was required to be proved.

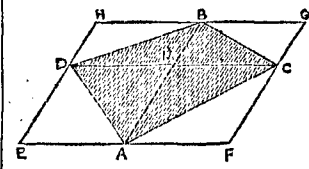


Fig. 59.

LESSONS IN FRENCH.—XLVIII.

PART II.

THIS Second Part of the Lessons in French, which we commence in the present lesson, differs from the first in containing a more systematic and complete exhibition of the principles of the language. The First Part, which was intended to serve as an introduction, supplied the learner with the means of speedily acquiring a knowledge of the most essential forms of speech, so as to be able to read, write, and converse in French on all ordinary subjects. The present part carries him on to the niceties of the language, and qualifies him for understanding and employing it in connection with any topic to which he may turn his attention, provided, of course, he has a good dictionary at hand. In a word, the First Part was practical, the Second is theoretical; in the former, the student was taught mainly by examples and exercises; in the latter, he is put in possession of the principles upon which those examples and exercises proceed.

At the same time, it must not be supposed that there is any lack of examples in this part. On the contrary, every rule is copiously illustrated by passages from the most distinguished French writers; and when we add that the rules thus abundantly exemplified comprise the various idiomatic usages, as well as the regular syntax of the language, it will be evident that nothing more than diligent study and careful practice is needed to make the self-educating student a good French scholar.

§ 1. PARTS OF SPEECH.

(1.) There are, in French, ten sorts of words or parts of speech:—

Nouns or Substantives,	Participles,
Articles,	Adverbs,
Adjectives,	Prepositions,
Pronouns,	Conjunctions,
Verbs,	Interjections.

(2.) These are divided into variable words and invariable words.

(3.) The variable words are those of which the termination admits of various changes; by these changes various modifications of meaning are expressed. The variable words are of six kinds:—

The Noun,	The Pronoun,
The Article,	The Verb,
The Adjective,	The Participle.

(4.) The invariable words are those of which the termination never changes:—

The Adverb,	The Conjunction,
The Preposition,	The Interjection.

(5.) All variable parts of speech have two numbers: the singular, which denotes but one, and the plural, which denotes more than one.

(6.) All variable parts of speech, except the verb, have two genders: the masculine and the feminine.

§ 2.—CASES OF NOUNS.

The cases* of nouns adopted by French grammarians are:—

(1.) The *sujet*: answering to the subject of the English, and to the nominative of the Latin.

(2.) The *régime direct*: answering to the direct object of the English, and to the accusative of the Latin.

(3.) The *régime indirect*: answering to the indirect object of the English, and to the oblique cases of the Latin—genitive, dative, and ablative.

§ 3.—THE NOUN OR SUBSTANTIVE.

(1.) The noun or substantive is a word which serves to name a person or a thing; as, *Jean, John; maison, house*.

* The word *case* is not taken here in the meaning it has in Latin grammar for instance. French, being an *analytic* language, its nouns are not inflected, and it shows the relations that words bear to each other in a sentence by *position* and *prepositions*; whilst Latin, being a *synthetic* language, points out such relations by *inflections* or *case-endings*. Thus in the sentence: *Le maître donne un livre à l'enfant*, we know that *maître* is subject, by its position before the verb; that *livre* is direct object, by its position after the verb; and that *enfant* is indirect object, by its being preceded by the preposition *à*.

(2.) There are two sorts of nouns: *proper* and *common*.

(3.) A proper noun is applied to a particular person or thing; as, *Napoléon, Napoleon; Paris, Paris*.

(4.) A common noun belongs to a whole class of objects; as, *livre, book; homme, man*.

(5.) Some common nouns, although singular in number, present to the mind the idea of several persons or things, forming a collection: they are for this reason denominated *collective* nouns; as, *troupe, troop; peuple, people*.

(6.) Collective nouns are general or *partitive*: *general*, when they represent an entire collection; as, *l'armée des Français, the army of the French*; *partitive*, when they represent a partial collection; as, *un troupe de soldats Français, a troop of French soldiers*.

(7.) A common noun composed of several words, as, *chef-d'œuvre, masterpiece, avant-coureur, forerunner*, is called a compound noun.

§ 4.—GENDER OF NOUNS.

(1.) There are, in the French language, only two genders: the masculine and the feminine.

(2.) The masculine gender belongs to men, and animals of the male kind; as, *Charles, Charles; lion, lion*.

(3.) The feminine gender belongs to women, and animals of the female kind; as, *Sophie, Sophia; lionne, lioness*.

(4.) The masculine and feminine genders have been given, in French, to the names of *inanimate objects*: thus, *papier, paper*, is masculine, and *plume, pen*, is feminine. Most nouns which are masculine and neuter in Latin are masculine in French; most nouns which are feminine in Latin are feminine in French.

§ 5.—RULES FOR DETERMINING GENDER BY THE MEANING.

Masculine Nouns.

(1.) Male beings; as, *homme, man; lion, lion*.

(2.) Objects to which male qualities are attributed: *ange, angel; génie, genius (a spirit); soleil, sun*.

(3.) The names of the seasons: *le printemps, the spring, &c.*; and of the months: *janvier, January; février, February, &c.*

(4.) The days of the week: *lundi, Monday; mardi, Tuesday, &c.*

(5.) The names of the cardinal points and the winds; as, *l'est, the East; l'ouest, the West, &c.* [See exceptions opposite.]

(6.) The names used in the French decimal system; as, *centime (hundredth part of a franc); kilogramme (1000 grammes, about two pounds); mètre, &c.*

(7.) Metals: *le fer, iron; l'acier, steel, &c.*

(8.) Colours: *le vert, green; le jaune, yellow*.

(9.) The names of empires and kingdoms when ending with a consonant: *le Danemark, Denmark; le Brésil, Brazil*.

(10.) Mountains: *le Jura, Mount Jura; le Puy-de-Dôme, the Puy de Dôme; le St. Bernard, Mount St. Bernard*.

(11.) The names of rivers when ending with a consonant: *le Rhin, the Rhine; le Nil, the Nile*.

(12.) The names of rivers when ending with a mute: *la Seine, the Seine; la Loire, the Loire*.

(13.) The names of countries when ending in a mute: *la France, France; l'Espagne, the Spain, &c.*

(14.) The names of countries when ending in a consonant: *le Mexique, Mexico; le Pérou, Peru*.

(15.) The names of mountains in the plural: *les Alpes, the Alps; les Pyrénées, the Pyrenees; les Vosges, the Vosges, &c.*

(16.) The names of rivers when ending with a mute: *la Seine, the Seine; la Loire, the Loire*.

(17.) The names of rivers when ending with a consonant: *le Rhin, the Rhine; le Nil, the Nile*.

(18.) The names of rivers when ending with a mute: *la Seine, the Seine; la Loire, the Loire*.

(19.) The names of rivers when ending with a consonant: *le Rhin, the Rhine; le Nil, the Nile*.

(20.) The names of rivers when ending with a mute: *la Seine, the Seine; la Loire, the Loire*.

(21.) The names of rivers when ending with a consonant: *le Rhin, the Rhine; le Nil, the Nile*.

(22.) The names of rivers when ending with a mute: *la Seine, the Seine; la Loire, the Loire*.

(23.) The names of rivers when ending with a consonant: *le Rhin, the Rhine; le Nil, the Nile*.

(24.) The names of rivers when ending with a mute: *la Seine, the Seine; la Loire, the Loire*.

(25.) The names of rivers when ending with a consonant: *le Rhin, the Rhine; le Nil, the Nile*.

(26.) The names of rivers when ending with a mute: *la Seine, the Seine; la Loire, the Loire*.

(27.) The names of rivers when ending with a consonant: *le Rhin, the Rhine; le Nil, the Nile*.

(28.) The names of rivers when ending with a mute: *la Seine, the Seine; la Loire, the Loire*.

(29.) The names of rivers when ending with a consonant: *le Rhin, the Rhine; le Nil, the Nile*.

(30.) The names of rivers when ending with a mute: *la Seine, the Seine; la Loire, the Loire*.

(31.) The names of rivers when ending with a consonant: *le Rhin, the Rhine; le Nil, the Nile*.

(32.) The names of rivers when ending with a mute: *la Seine, the Seine; la Loire, the Loire*.

(33.) The names of rivers when ending with a consonant: *le Rhin, the Rhine; le Nil, the Nile*.

(34.) The names of rivers when ending with a mute: *la Seine, the Seine; la Loire, the Loire*.

(35.) The names of rivers when ending with a consonant: *le Rhin, the Rhine; le Nil, the Nile*.

(36.) The names of rivers when ending with a mute: *la Seine, the Seine; la Loire, the Loire*.

(37.) The names of rivers when ending with a consonant: *le Rhin, the Rhine; le Nil, the Nile*.

(38.) The names of rivers when ending with a mute: *la Seine, the Seine; la Loire, the Loire*.

(39.) The names of rivers when ending with a consonant: *le Rhin, the Rhine; le Nil, the Nile*.

(40.) The names of rivers when ending with a mute: *la Seine, the Seine; la Loire, the Loire*.

(41.) The names of rivers when ending with a consonant: *le Rhin, the Rhine; le Nil, the Nile*.

(42.) The names of rivers when ending with a mute: *la Seine, the Seine; la Loire, the Loire*.

(43.) The names of rivers when ending with a consonant: *le Rhin, the Rhine; le Nil, the Nile*.

(44.) The names of rivers when ending with a mute: *la Seine, the Seine; la Loire, the Loire*.

(45.) The names of rivers when ending with a consonant: *le Rhin, the Rhine; le Nil, the Nile*.

(46.) The names of rivers when ending with a mute: *la Seine, the Seine; la Loire, the Loire*.

(47.) The names of rivers when ending with a consonant: *le Rhin, the Rhine; le Nil, the Nile*.

(48.) The names of rivers when ending with a mute: *la Seine, the Seine; la Loire, the Loire*.

(49.) The names of rivers when ending with a consonant: *le Rhin, the Rhine; le Nil, the Nile*.

(50.) The names of rivers when ending with a mute: *la Seine, the Seine; la Loire, the Loire*.

(51.) The names of rivers when ending with a consonant: *le Rhin, the Rhine; le Nil, the Nile*.

(52.) The names of rivers when ending with a mute: *la Seine, the Seine; la Loire, the Loire*.

(53.) The names of rivers when ending with a consonant: *le Rhin, the Rhine; le Nil, the Nile*.

(54.) The names of rivers when ending with a mute: *la Seine, the Seine; la Loire, the Loire*.

(55.) The names of rivers when ending with a consonant: *le Rhin, the Rhine; le Nil, the Nile*.

(56.) The names of rivers when ending with a mute: *la Seine, the Seine; la Loire, the Loire*.

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(58.) The names of rivers when ending with a mute: *la Seine, the Seine; la Loire, the Loire*.

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(60.) The names of rivers when ending with a mute: *la Seine, the Seine; la Loire, the Loire*.

(61.) The names of rivers when ending with a consonant: *le Rhin, the Rhine; le Nil, the Nile*.

(62.) The names of rivers when ending with a mute: *la Seine, the Seine; la Loire, the Loire*.

(63.) The names of rivers when ending with a consonant: *le Rhin, the Rhine; le Nil, the Nile*.

(64.) The names of rivers when ending with a mute: *la Seine, the Seine; la Loire, the Loire*.

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(66.) The names of rivers when ending with a mute: *la Seine, the Seine; la Loire, the Loire*.

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(79.) The names of rivers when ending with a consonant: *le Rhin, the Rhine; le Nil, the Nile*.

(80.) The names of rivers when ending with a mute: *la Seine, the Seine; la Loire, the Loire*.

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(82.) The names of rivers when ending with a mute: *la Seine, the Seine; la Loire, the Loire*.

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(90.) The names of rivers when ending with a mute: *la Seine, the Seine; la Loire, the Loire*.

(91.) The names of rivers when ending with a consonant: *le Rhin, the Rhine; le Nil, the Nile*.

(92.) The names of rivers when ending with a mute: *la Seine, the Seine; la Loire, the Loire*.

(93.) The names of rivers when ending with a consonant: *le Rhin, the Rhine; le Nil, the Nile*.

(94.) The names of rivers when ending with a mute: *la Seine, the Seine; la Loire, the Loire*.

(95.) The names of rivers when ending with a consonant: *le Rhin, the Rhine; le Nil, the Nile*.

Masculine Nouns.	Feminine Nouns.
(12.) Trees, shrubs: le chêne, the oak; le frêne, the ash; le rosier, the rose-bush. [Exceptions opposite.]	(9.) Aubépine, hawthorn; bourdaine, black alder; épine, thorn; hêtre, dwarf-elder; ronce, briar; yucca, ilex.
(13.) The names of languages; as, le français, French; l'allemand, German, &c.	
(14.) The letters of the alphabet: un a, an a; un z, a z.	
(15.) Compound words formed of a verb and of a noun, either masculine or feminine, or of a verb and a pronoun: portefeuille, pocket-book; rendez-vous, rendez-vous.	(10.) Garde-robe, wardrobe; perce-neige, snowdrop; perce-feuille, hare's-ear.
(16.) Nouns, pronouns, verbs, &c., used substantively: le boire et le manger, eating and drinking.	
(17.) Numbers—cardinal, ordinal, and proportional—used substantively: le dix, the tenth; le neuvième, the ninth; le tiers, the third. [Exceptions opposite.]	(11.) Moitié, half; and all numbers ending with aine: douzaine, dozen; centaine, hundred, &c.

§ 6.—GENDER, BY THE TERMINATION.

(1.) The exceptions to the masculine will be found opposite the termination, in the feminine column; and the exceptions to the feminine, in the masculine column, also opposite:—

(2.) Consonantal Terminations.

Masculine.	Feminine.
Terminations.	Terminations.
EB Horeb, Mount Horeb.	UB radoub, refitting a ship.
MB plomb, lead.	
AC sac, sack.	
EC bec, beak.	
IC mastic, putty.	
OC soc, ploughshare.	
UC duc, duke.	
NC tronc, trunk.	
RC clerc, clerk.	
SC fisc, revenue.	
ED pied, foot.	
ID nid, nest.	
UD Talmud, Talmud.	
MD marchand, merchant.	
RD bord, border.	
EF chef, chief.	
IF suif, tallow.	
VF œuf, egg.	
RF cerf, stag.	
NG rang, rank.	
CK arack, arrack.	
AL bal, ball.	
EL sel, salt.	
IL soleil, sun.	
OL sol, soil.	
VL calcul, calculation.	
AM Adam, Adam.	
EM harem, harem.	
IM daim, deer.	
OM nom, name.	
UM parfum, perfume.	
AN cadran, dial.	
EN examen, examination.	
IN raisin, grape.	

Masculine.	Feminine.
Terminations.	Terminations.
OX not preceded by is or gi, si, ti, xi.	Exc.—chanson, song; cuisson, baking; catrefaçon, counterfeiting; façon, mode; moisson, harvest; monsoon, monsoon; rançon, ransom.
IX biton, stick.	
IX gazon, turf.	
IX blason, blazon.	
ISON bison, bison; horizon, horizon; oison, gosling; poison, poison; tison, firebrand.	ISON maison, house. Exceptions opposite.
IX bastion, bastion; bestion, figure-head of a ship.	
AP drap, cloth.	
OP galop, gallop.	
UP conp, blow.	
OQ coq d'Inde, turkey.	
AR char, car.	
ER fer, iron.	
IR plaisir, pleasure.	
OR or, gold.	
UR not preceded by e.	
UR azur, azure.	
UR bonheur, happiness; cœur, heart; chœur, chorus; dénominateur, denominator; déshonneur, dishonour; équilibre, equilibrium; extérieur, exterior; honneur, honour; intérieur, interior; labeur, labour; malheur, misfortune; multiplicateur, multiplier; pleurs, tears; régulateur, regulator; ventilateur, ventilator.	Exc.—cuiller, spoon; mer, sea. chair, flesh. Exc.—tour, tower. Exceptions opposite.
AS bras, arm.	
ES grès, sandstone.	
IS souris, mouse.	
OS os, bone.	
US blocus, blockade.	
RS temps, weather.	
RS vers, verse.	
AT climat, climate.	
ET arrêt, arrest.	
IT lit, bed.	
OT cachot, dungeon.	
UT bout, end.	
NT pont, bridge.	
RT tort, wrong.	
AX thorax, thorax.	
EX silex, silica.	
IX prix, price.	
IX courroux, anger.	
IX lynx, lynx.	
AZ gaz, gas.	
IZ nez, nose.	
IZ riz, rice.	

KEY TO EXERCISES IN LESSONS IN FRENCH.

EXERCISE 167 (Vol. II., page 332).

1. Have your uncles, cousins, and nephews given up commerce? 2. They have abandoned commerce, and have turned physicians. 3. Has not captain G. left the army? 4. He has left France, but he has not left the army. 5. Where have you left your son? 6. I left him at a boarding-school. 7. Is he too young to abandon his studies? 8. He is too young; he is only twelve. 9. With whom have you left your card? 10. I left it with the porter. 11. Why do you not let him speak? 12. Because it is time for us to leave you. 13. Do you

permit me to communicate that to him? 14. I leave you a free choice with regard to that (You may do as you please). 15. Has not that young man given up his bad habits? 16. He has given them up. 17. Has not Mr. L. left the gown (the law) for the sword (the army)? 18. Yes, Sir; he is no longer a judge; he is a captain. 19. Do these peaches leave the stone easily? 20. No, Sir, they are cling-stones. 21. I will let you have that coat for fifty francs. 22. At what price will you let me have it? 23. I will let you have it for ten francs. 24. I let you have it cheap, I cannot let you have it for less.

EXERCISE 168 (Vol. II., page 332).

1. Le fils, la fille, et la cousine ont quitté Paris. 2. Mon père, ma mère, et ma sœur, m'ont laissé ici. 3. Aimez-vous à quitter votre pays? 4. Je n'aime pas à quitter mes amis et mon pays. 5. Mes parents n'aiment pas à me laisser ici; je suis trop jeune. 6. Pourquoi M. votre frère ne laisse-t-il pas parler son fils? 7. Parce qu'il n'a rien à dire. 8. L'avez-vous laissé tranquille? 9. Je l'ai laissé tranquille. 10. Pourquoi ne me laissez-vous pas tranquille? 11. Je les laisserai tranquilles. 12. Votre ami a-t-il quitté le lit? 13. Il n'a pas encore quitté le lit; il est encore très malade. 14. Le capitaine G. a-t-il quitté le service? 15. Il n'a pas quitté le service. 16. Ce monsieur n'a-t-il pas quitté l'épée (le service) pour le barreau? 17. Il a quitté le service pour le barreau. 18. Mon ami a quitté le barreau. 19. A quel prix me laisserez-vous cette soie? 20. Je vous la laisserai à raison de deux francs le yard. 21. Ne pouvez-vous me la laisser à moins? 22. Je vous la laisse à bon compte. 23. Voulez-vous me laisser ce livre pour vingt francs? 24. Je vous le laisserai pour vingt-deux francs. 25. Je ne saurais vous le laisser à moins. 26. A qui avez-vous laissé mon livre? 27. Je l'ai laissé à votre sœur. 28. Pourquoi ne l'avez-vous pas laissé à mon domestique? 29. Parce qu'il avait quitté votre maison. 30. Aimez-vous à quitter vos amis? 31. Je n'aime pas à les quitter. 32. Où avez-vous laissé votre livre? 33. Je l'ai laissé chez mon père. 34. Ce négociant a-t-il quitté le commerce? 35. Il ne l'a pas quitté. 36. Ces péches ne quittent pas facilement le noyau; ce sont des paries.

EXERCISE 169 (Vol. II., page 365).

1. Do you not recognise your friend? 2. I recognise her by her light hair. 3. By what do you recognise that young lady? 4. I recognise her by her graceful walk. 5. Would you not have known your friend by his voice? 6. I should have recognised him by it. 7. By the work we know the workman (mechanic). 8. Will you not recognise him by these marks? 9. I shall recognise him by them. 10. Is not that goldsmith a judge of this? 11. He is not at all a judge of it. 12. Are you as good a judge of it as the blacksmith? 13. I am quite as good a judge of it as he. 14. Are you not a judge of poetry? 15. I know but little about it. 16. Is the manufacturer as good a judge of cloth as of grain? 17. He is a better judge of that than of this. 18. Do you not know that gentleman by his vehement gestures? 19. I know him by his curled hair. 20. Have you not told your name (made yourself known)? 21. I told my name. 22. Shall we not tell our names? 23. You will tell your names. 24. They will make themselves known by their virtues.

LESSONS IN GREEK.—XXI.

THE NUMERALS.—RECAPITULATORY EXERCISES.

The numerals express the relation of number. According to their import they may be divided into five classes: 1, the cardinals; 2, the ordinals; 3, the multiplicatives; 4, the proportionals; and 5, the substantive numerals.

The foundation of the whole are the cardinals, or the chief, so called because they are the hinge (in Latin, *cardo*) on which the others turn. The cardinals answer to the question *how many?* as one, two, five, etc. Of the cardinals, the four that come first, and the round numbers from 200 (*διακοσμία*) up to 10,000 (*μυρία*), as well as the compounds of *μυρία*, have the inflections of adjectives; all the rest are indeclinable. The thousands are formed by the help of numeral adverbs: for example, *τρί-χιλιάς*, 3,000.

The ordinals denote the order in which the numbers follow, or the place in the series held by a particular number; as the fourth, *τέταρτος*. They are all inflected like adjectives of three terminations.

The multiplicatives denote *how often* a quality is repeated, as *tenfold, fourfold*; they are compounds of *πλούς*, and have three adjectival terminations, *-ους, -η, -ων*, as *διπλούς*. Then there are numeral adverbs in *-akis*, which answer to the question *how often?* as *ἐκατοντάκις*, a hundred times.

The proportionals are compounds of *πλάσιος, -α, -ον*, and denote so much the more than some other object, as *διπλάσιος*, twice as much.

The substantive numerals express the abstract idea of number, as *ἡ δυάς*, gen. *-αδος*, duality.

The alphabet furnishes signs for numbers, as well as supplies

the elements of words. Hence, with the Greeks, the four-and-twenty letters of the alphabet are so many ciphers. In the series, however, three obsolete forms are introduced, namely, after the letter *βau* or *digamma*, *Γ*, or *Στ*, that is, *ς*, as the sign for 6; also *κομμα*, that is, *ϙ*, as the sign for 90; and *Σαμπι*, *Δ*, as the sign for 900.

The first eight letters, from *alpha* to *theta*, *bau* or *sti* included, make the first series consisting of units; the ensuing eight, from *iota* to *pi*, including *koppa*, form the second series, or the succession of tens; and the remaining eight, from *rho* to *omega*, together with *sampi*, make up the hundreds. Eleven is *ια'*, or 10 and 1; twelve is *ιβ'*, 10 and 2, etc.

Up to 999, the letters when used as figures have an accent over them each, thus *α'*. When more than one sign stand together, the mark is over the last, thus *αγ'*. With 1000 the alphabet begins afresh. In order to indicate this the mark is placed under the letter—thus *α' = 1*, but *α = 1000*; *ι' = 10*, but *ι = 10,000*. The year 1869 in Greek numerals is written thus, *αωβθ'*, 1869.

I here subjoin lists of the cardinals and the ordinals, accompanied by our numbers and the corresponding Greek signs. The English words, *one, two, three*, etc., need scarcely be added, and of course *first, second, third, tenth*, etc., will readily be supplied by the student.

Cardinals.	Ordinals.
1. α' εἰς, μια, ἐν.	πρῶτος, -η, -ον.
2. β' δύο, ὁ δυώ.	δευτερός, -α, -ον.
3. γ' τρεῖς, τρία.	τρίτος, -η, -ον.
4. δ' τέτταρ-ες, -α, ὁ τεσσαρ-	τέταρτος, -η, -ον.
5. ε' πέντε.	πέμπτος, -η, -ον.
6. ς ἕξ.	ἕκτος, -η, -ον.
7. ζ' ἑπτα.	ἑβδόμος, -η, -ον.
8. η' οκτώ.	ογδοός, -η, -ον.
9. θ' ἐννεα.	ἐννατός, -η, -ον.
10. ι' δεκα.	δεκάτος, -η, -ον.
11. ια' ἑνδεκα.	ἐνδεκάτος, -η, -ον.
12. ιβ' δωδεκα.	δωδεκάτος, -η, -ον.
13. ιγ' τρισκαίδεκα.	τρισκαίδεκάτος, -η, -ον.
14. ιδ' τετταρακαίδεκα, ὁ τεσσαρ-	τετταρακαίδεκάτος, -η, -ον.
15. ιε' πεντεκαίδεκα.	πεντεκαίδεκάτος, -η, -ον.
16. ις' ἑκκαίδεκα.	ἑκκαίδεκάτος, -η, -ον.
17. ιζ' ἑπτακαίδεκα.	ἑπτακαίδεκάτος, -η, -ον.
18. ιη' οκτωκαίδεκα.	οκτωκαίδεκάτος, -η, -ον.
19. ιθ' ἐννεακαίδεκα.	ἐννεακαίδεκάτος, -η, -ον.
20. κ' εικοσι(v).	εικοστός, -η, -ον. [-η, -ο, -α]
21. κα εικοσιν εἰς, μια, ἐν.	εικοστός, -η, -ον, πρῶτος,
30. λ' τριακοντα.	τριακστός, -η, -ον.
40. μ' τετταρακοντα, ὁ τεσσαρ-	τετταρακστός, -η, -ον.
50. ν' πεντηκοντα.	πεντηκστός, -η, -ον.
60. ς' ἑξήκοντα.	ἑξήκιστος, -η, -ον.
70. ο' ἑβδομηκοντα.	ἑβδομηκιστός, -η, -ον.
80. π' ογδοηκοντα.	ογδοηκιστός, -η, -ον.
90. ϑ' ἐνενηκοντα.	ἐνενηκιστός, -η, -ον.
100. ρ' ἑκατον.	ἑκατόστος, -η, -ον.
200. σ' διακοσμοί, -αι, -α.	διακοσιστός, -η, -ον.
300. τ' τριακοσμοί, -αι, -α.	τριακοσιστός, -η, -ον.
400. υ' τετρακοσμοί, -αι, -α.	τετρακοσιστός, -η, -ον.
500. φ' πεντακοσμοί, -αι, -α.	πεντακοσιστός, -η, -ον.
600. χ' ἑξακοσμοί, -αι, -α.	ἑξακοσιστός, -η, -ον.
700. ψ' ἑπτακοσμοί, -αι, -α.	ἑπτακοσιστός, -η, -ον.
800. ω' οκτακοσμοί, -αι, -α.	οκτακοσιστός, -η, -ον.
900. Δ' ἐννακοσμοί, -αι, -α.	ἐννακοσιστός, -η, -ον.
1000. α' χίλιοι, -αι, -α.	χιλιοστός, -η, -ον.
2000. β' διαχίλιοι, -αι, -α.	δισχιλιοστός, -η, -ον.
3000. γ' τρισχίλιοι, -αι, -α.	τρισχιλιοστός, -η, -ον.
4000. δ' τετρακισχίλιοι, -αι, -α.	τετρακισχιλιοστός, -η, -ον.
5000. ε' πεντακισχίλιοι, -αι, -α.	πεντακισχιλιοστός, -η, -ον.
6000. ς' ἑξακισχίλιοι, -αι, -α.	ἑξακισχιλιοστός, -η, -ον.
7000. ζ' ἑπτακισχίλιοι, -αι, -α.	ἑπτακισχιλιοστός, -η, -ον.
8000. η' οκτακισχίλιοι, -αι, -α.	οκτακισχιλιοστός, -η, -ον.
9000. θ' ἐννακισχίλιοι, -αι, -α.	ἐννακισχιλιοστός, -η, -ον.
10,000. ι' μυρία, -αι, -α.	μυριοστός, -η, -ον.
20,000. κ' δισμυρία, -αι, -α.	δισμυριοστός, -η, -ον.
100,000. ρ' δεκακισμυρία, -αι, -α.	δεκακισμυριοστός, -η, -ον.

In forming compound numbers you may put the smaller first and the larger second, interposing *kai*, and; as, *πέντε καὶ εἰκοστί*, five-and-twenty; or you may reverse the order, still, however,

keeping the conjunction, as *εικοσι και πεντε*, twenty and five, 25. Thus, 345 will be either *πεντε και τετταρακοντα και τριακοσιοι*, or *τριακοσιοι και τετταρακοντα και πεντε*.

DECLENSION OF THE FOUR FIRST NUMERALS,

Namely, *εις, one; δυο, two; τρεις, three; τετταρες, four.*

	μ.	ν.	ν.
Nom.	<i>εις, μια, εν; δυο.</i>		
Gen.	<i>ενος, μιας, ενος; δυοιν.</i>		
Dat.	<i>ενι, μι, ενι; δυοιν.</i>		
Acc.	<i>ενα, μιαν, εν; δυο.</i>		
Nom.	<i>τρεις, τρια; τετταρες, τετταρα.</i>		
Gen.	<i>τριων, τετταρων.</i>		
Dat.	<i>τρισι, τετταραι. Poet. τετρασι.</i>		
Acc.	<i>τρεις, τρια; τετταρας, τετταρα.</i>		

Like *εις*, decline its compounds, *ουδεις* and *μηδεις*, no one: thus, *ουδεις, ουδεμια, ουδεν; gen., ουδενος, ουδεμιας, etc.* Plural, *ουδενες, ουδεμια, ουδενα, ουδεμων, ουδεσι, etc.*; the *δ* is euphonic.

Δυο is often used as an indeclinable word for all cases. The numeral *αμφω*, both, has, like *δυο*, in the genitive and dative *οιν*—thus, *αμφωιν*; the accusative is the same as the nominative; like *δυο*, *αμφω* is sometimes used as an indeclinable.

VOCABULARY.

<i>Αναβάσις, -ως, η, a going up, an expedition.</i>	<i>Κυδνος, -ου, δ, the Cydnus.</i>	<i>Πους, ποδος, δ (Lat. pes) a foot.</i>
<i>Αριθμος, -ου, δ, a number.</i>	<i>Μυριας, -αδος, η, the number 10,000.</i>	<i>Ρωμαιος, -ου, δ, a Roman.</i>
<i>Άρμα, αρμάτος, το, a carriage.</i>	<i>Όπλιτης, -ου, δ, a heavy-armed soldier.</i>	<i>Σαρος, -ου, δ, the river Sarus.</i>
<i>Βαβυλων, -ωνος, -ή, Babylon.</i>	<i>Παρασαγγης, -ου, δ, a parasang, a Persian measure of length=30stadia.</i>	<i>Σταδιον, -ου, το, a stadium = 600 Greek or 606½ English feet.</i>
<i>Βαρβαρος, δ, a barbarian, every one not a Greek.</i>	<i>Παρεμι, I am present.</i>	<i>Σταβος, -ου, δ, a station, a day's march, stage=5 parasangs or leagues.</i>
<i>Βημα, -ατος, το, a step, stride.</i>	<i>Πελοποννησος, -ου, η, Peloponnesus.</i>	<i>Στρατευμα, -ατος, το, an army.</i>
<i>Δρεπανηφορος, -ον, scythe-bearing.</i>	<i>Πελταστής, -ου, δ, a shield-bearer, targeteer.</i>	<i>Συγγραφω, I describe (γραφω, I engrave, write).</i>
<i>Ενιαυτος, -ου, δ, a year.</i>	<i>Πελτη, -ης, η, a small light shield.</i>	<i>Συμπας, -ασα, -αν, all, all together, total.</i>
<i>Ευρος, -ους, το, breadth.</i>	<i>Περσικος, -ης, -ον, Persian.</i>	<i>Συνετος, -ης, -ον, intelligent.</i>
<i>Ευφρατης, -ου, δ, the river Euphrates.</i>	<i>Πλεθρον, -ου, το, a plethron = 101 feet English, or ½ of a stadium.</i>	<i>Φρυγια, -ας, η, Phrygia.</i>
<i>Καταβάσις, -ως, η, a going down, retreat.</i>	<i>Πληθος, -ους, το, a multitude.</i>	
<i>Κιλικια, -ας, η, Cilicia.</i>		
<i>Κοτυωρα, -ων, τα, Cotyora, a town in Pontus.</i>		

EXERCISE 70.—GREEK-ENGLISH.

1. *Ο Ευφρατης ποταμος εστι το ευρος τετταρων σταδιων.* 2. *Το δε σταδιον εχει παρα τοις Ρωμαιοις πεντε και εικοσι και εκατον βηματα, η πεντε και εικοσι και εξακοσιους ποδας.* 3. *Κυρω παρησαν αι εκ Πελοποννησου νηες τριακοντα πεντε.* 4. *Του Σαρον, Κιλικιας ποταμου, το ευρος ην τρια πλεθρα.* 5. *Το δε πλεθρον εχει εκατον ποδας.* 6. *Κυδνος, Κιλικιας ποταμος, ευρος εστι δυο πλεθρων.* 7. *Του Μαιανδρου, Φρυγιας ποταμου, το ευρος εστιν εικοσι πεντε ποδων.* 8. *Ο παρασαγγης, Περσικον μετρον, εχει τριακοντα σταδια η πεντηκοντα και επτακοσιους και οκτακισχιλιους και μυριας ποδας.* 9. *Αριθμος συμπασης της δδου της αναβασεως και καταβασεως, η υπο Ευνοφωντος συγγραφεται, ησαν σταδια διακοσιοι δεκα πεντε, παρασαγγαι χιλιοι εκατον πεντηκοντα πεντε, σταδια τρισμυρια τετρακισχιλια εξακοσια πεντηκοντα, χρονον πληθος της αναβασεως και καταβασεως ενιαυτος και τρεις μηνες.* 10. *Ενος φιλια συνετος κρειττων εστιν ασυνετων απαντων.* 11. *Του Κυρου στρατευματος ην αριθμος των μεν Έλληων οπλιται κυριοι και τετρακοσιοι, πελτασται δε διαχιλιοι και πεντακοσιοι, των δε μετα Κυρου Βαρβαρων δεκα μυριαδες και αρματα δρεπανηφορα αμφι τα εικοσι.*

EXERCISE 71.—ENGLISH-GREEK.

1. It is better to have one intelligent friend than many unintelligent ones. 2. Seventy years produce about (αμφι and acc.) 25,555 days. 3. The sum total of the way from the battle at (εν) Babylon to (εις) Cotyora, of the retreat, which Xenophon describes, is 122 stages, 620 parasangs, 18,600 stadia, the length

of the time eight months. 4. The number of the army is 39,850. 5. (There) are four generals of the army, each of the four of (that is, commanding) 30,990 soldiers. 6. In the battle (there), were present 96,950 soldiers and 150 scythe-bearing chariots.

KEY TO EXERCISES IN LESSONS IN GREEK.—XX.

EXERCISE 68.—GREEK-ENGLISH.

1. This man is good. 2. This judgment is just. 3. This woman is beautiful. 4. That man is a king. 5. The king himself is general. 6. O boy, bear him the key. 7. Some do not know the same things concerning the same people on the same day. 8. To speak and to act is not the same thing. 9. These roses which bloom in the garden are lovely. 10. Man is a certain clever contrivance. 11. If you cultivate the friendship of any man, examine carefully into his character. 12. Who writes this letter? 13. Tell me who writes this letter. 14. To others communicate of the things which you have. 15. He is happy who has kind children. 16. That man is most happy who has no calamity. 17. Why do you take anxious thought? 18. I cannot tell why I take anxious thought. 19. As is the disposition of each, such is his manner of life. 20. Who is that woman yonder? 21. Tell me who is that woman yonder.

EXERCISE 69.—ENGLISH-GREEK.

1. *Οι ανδρες ουτοι εισιν αγαθοι.* 2. *Εκειναι αι δοξαι εισι οικαιαι.* 3. *Τα τεκνα ταυτης της γυναικος εστι καλα.* 4. *Εκεινα τα ροδα εστι καλα.* 5. *Ο πατηρ αυτου γραφει την επιστολην.* 6. *Ο υιος αυτου εστι σοφος.* 7. *Αυτου η θυγατηρ εστι καλη.* 8. *Εκεινα τα καλα ροδα θανιαζω, αυτα φερε μοι.* 9. *Τα τεκνα των αυτων τοκεων πολλη και εισιν ετερα.* 10. *Τουτο το ροδον ο εν τη κηπη θαλλει, εστι καλον.*

GREAT BOOKS.

XVII.—THE WAVERLEY NOVELS.

THE Historic Novel is to a great extent the creation of modern times, though, like most other things, its beginnings are to be found in the ancient world. One might perhaps say that the "Iliad" is a historical romance in verse, for there can be little doubt that some degree of truth is combined with its mythical incidents. But we have a more genuine counterpart of the modern historic novel in the "Cyropaedia" of Xenophon, which, while in the main fictitious, is thought to have a basis of fact. Lower down the stream of ages, we find, in the romances of chivalry associated with the heroic names of Arthur, Charlemagne, and the Cid, references to real persons, if not to real events, together with scenes of enchantment, and circumstances of an impossible character. Nevertheless, the assertion holds good that the Historic Novel, as we now understand the term, is a plant of very recent growth, although it seems to be already far advanced in its decay. The founder of the school was Sir Walter Scott, and it is probable that he will for ever remain its greatest master. He came at a time peculiarly fitted for such productions, and Nature had endowed him with a genius in which the love of romance was curiously blended with a devotion to antiquarian lore. The school of fiction founded by Richardson, Fielding, Smollett, and Goldsmith, had lost its freshness and power, and the writings of Mrs. Radcliffe and others had created a taste for the picturesque and romantic. Scott himself began his literary career by writing narrative poems of mediæval adventure. It was an age of revival, in which the manners and external forms of earlier days exercised a remarkable fascination over the public mind. The author of "Waverley" was in thorough harmony with this feeling; and it was as a writer of historical romance that he achieved his greatest and most permanent triumphs.

The metrical stories of Scott were beginning to pall by repetition, and to fade before the greater poetic energy of the somewhat similar compositions of Byron, when, in the year 1814, the former published his prose romance of "Waverley"; or, "Tis Sixty Years Since." The second name was misleading, for the period of the novel is 1745, the time of the Second Pretender; but the story had been written some years before, and an alteration in the sub-title would not have been convenient. No author's name was attached to the production, and it may be said to have stolen into the world in as unobtrusive a way as any book which afterwards became famous. "The work," Scott himself wrote in a General Preface to the "Waverley" series in 1829, "was left to win its way in the world without any of the usual recommendations. Its progress was for some time slow; but, after the first two or three

months, its popularity had increased in a degree which must have satisfied the expectations of the author, had these been far more sanguine than he ever entertained." The structure of the story, as the writer subsequently admitted, showed signs of immaturity; but the public were attracted by its freshness, its picturesque power, and the novelty of the scenes of Scottish life to which it introduced the reader. Within the next four years, "Waverley" was followed by "Guy Mannering," "The Antiquary," "The Black Dwarf," "Old Mortality," "Rob Roy," and "The Heart of Mid-Lothian;" many others came later.

All these tales, like the first of the set, were published anonymously, and the stories were known as "The Waverley Novels," or "The Scotch Novels." Considerable curiosity was manifested to know who the author really was, and the mystery, which was well sustained, may possibly have added to the success of the works. The original motive for concealment was that the author was doubtful of the reception which he would meet, and did not care to be identified with failure. Afterwards, the mask continued to be worn out of a certain whimsical feeling, which found a pleasure in the wonderment of the public. Numerous were the guesses as to the personality of the author of "Waverley;" some plausible, others ridiculous. In time, Scott came to be generally regarded as the creator of these interesting fictions, and he was sometimes put to awkward straits by being asked in direct terms if such was not the fact. It is rather unpleasant to learn, on his own authority, that he used to meet these questions by a positive denial. He considered (and, indeed, rightly so) that no one was entitled to drag from him a secret which it was his pleasure to keep; and he placed his denial on the same formal and purely defensive footing—apart from all questions of truth or falsehood—as the plea of "Not Guilty" advanced by a criminal on his trial. Byron is said to have told a friend that Scott, talking with him one day in the office of Mr. Murray, the publisher, inadvertently admitted, by implication, that the Scotch Novels were his; and to all the author's friends and associates it was an open secret. The fact, however, was not specifically divulged until February, 1827, when Scott himself avowed his long-veiled authorship at the anniversary dinner of the Edinburgh Theatrical Fund Association.

Scott was forty-three years old when the story of "Waverley" was published. It is not often at such an age that a man who has for many years been labouring with the pen strikes out a new line of imaginative creation, achieves in that line the most brilliant and lasting success, and, though dying at the comparatively early age of sixty-one, lives to produce an immense number of works in the particular class of literature to which, until middle life, he had been a stranger. The great novelist expired on the 21st of September, 1832, and he continued writing up to within less than two years of his decease, alternating fiction with historical, biographical, and other literature. For a long time, however, he had been overworking himself, owing to pecuniary embarrassments, and his later novels are generally allowed to have been far inferior to his earlier. But the best of these works are a gain of a very high order to the world of fiction. The author of "Waverley" had a deep knowledge and keen appreciation of Scotch nature and Scotch manners, and was especially at home when depicting them. But he was too cosmopolitan a man to confine himself to one circle, and his reproduction of the England of past times is vivid and sympathetic. It was in the past that he mainly lived, and this it was which made him the greatest writer of historical romance that we have had. His imitators were numerous, and some were distinguished; but not one has attained his eminence, with the exception of Lord Lytton. For several years after the death of Sir Walter Scott, historical fiction continued to form one of the principal branches of novel-writing; but it has recently fallen into disrepute. After a while, the style degenerated into a trick; the art became vulgarised by inferior hands; critics discovered an element of untruthfulness in what had once been so highly admired; and even the uncritical began to fear that their conceptions of actual history ran some danger of being vitiated by the kaleidoscopic effects of the romance-writer. The tendency of the present day is towards realism in art; but it is possible that future times may witness a reaction in favour of the kind of story-telling of which Scott set the example in "The Waverley Novels."

LESSONS IN ALGEBRA.—XI.

ADDITION OF FRACTIONS.

To ADD fractional quantities together.

135. Rule.—Reduce the given fractions to fractions having a common denominator if necessary; then add their numerators, and place the sum over the common denominator.

EXAMPLES.—(1.) Add $\frac{2}{16}$ and $\frac{4}{16}$ of a pound. Ans. $\frac{2+4}{16}$ or $\frac{6}{16} = \frac{3}{8}$ of a pound.

(2.) Add $\frac{a}{b}$ and $\frac{c}{d}$ together.

Here, reducing them to a common denominator, they become $\frac{ad}{bd}$ and $\frac{bc}{bd}$, whence their sum is $\frac{ad+bc}{bd}$. Ans.

136. For many purposes, it is sufficient to add fractions in the same manner as integers are added, by writing them one after another with their proper signs.

EXAMPLE.—Find the sum of $\frac{a}{b}$, $\frac{3}{y}$, and $-\frac{2}{2m}$.

Here the sum is simply $\frac{a}{b} + \frac{3}{y} - \frac{2}{2m}$. Ans.

137. To add fractions and integers together.

Write them one after another with their signs; or convert the integers into fractions, reduce the fractions to a common denominator, and then add as before.

EXERCISE 18.

- Find the sum of $\frac{m}{d}$ and $-\frac{2r+d}{3h}$.
- Find the sum of $\frac{a}{d}$ and $-\frac{b-m}{y}$.
- Find the sum of $\frac{a}{y}$ and $-\frac{d}{m}$.
- Find the sum of $\frac{a}{a+b}$ and $\frac{b}{a-b}$.
- Add $-\frac{a}{d}$ to $-\frac{h}{m-r}$.
- Add $-\frac{4}{2}$ to $-\frac{16}{7-3}$.
- Add $\frac{4a}{b}$, $\frac{6c}{d}$, and $\frac{3m}{3x}$ together.
- Add $\frac{2xy}{2}$, $\frac{hx}{y}$, and $\frac{ax}{c} + \frac{2}{a}$ together.
- Add $a + \frac{b}{2}$, $c + \frac{d}{x}$, xy , and $\frac{a-b}{4}$ together.
- Add $42 - \frac{2b}{c}$, $a - \frac{b+c}{3x}$, and $a + \frac{b+c}{3x}$ together.
- Add $\frac{3a}{2c} - \frac{x-y}{c}$, $\frac{axy}{2c}$, and $\frac{8ab}{4c}$ together.
- Add $2a + x$, $\frac{8x+10}{2}$, and $-\frac{3bx+4b}{b}$ together.
- What is the sum of a and $\frac{b}{m}$?
- What is the sum of $3d$ and $\frac{h+y}{m-y}$?
- What is the sum of $5x$ and $\frac{a+3y}{c}$?

SUBTRACTION OF FRACTIONS.

138. Rule.—Change the sign of the subtrahend, that is, of the fraction to be subtracted; and then proceed as in addition of fractions.

EXAMPLE.—From $\frac{a}{b}$ subtract $\frac{h}{m}$.

Here, reducing the fractions to a common denominator, they become $\frac{am}{bm}$ and $\frac{bh}{bm}$. Now, changing the sign of the subtrahend,

we have $\frac{am}{bm} - \frac{bh}{bm}$; then, proceeding as in addition of fractions,

we have $\frac{am}{bm} - \frac{bh}{bm} = \frac{am-bh}{bm}$. Ans.

EXERCISE 19.

- From $\frac{a+y}{r}$ subtract $\frac{h}{d}$.
- From $\frac{a}{m}$ subtract $\frac{d-b}{y}$.
- From $\frac{cd}{a}$ subtract $\frac{ab+b}{ab}$.
- From $\frac{a+3d}{4}$ subtract $\frac{3a-2d}{3}$.
- From $\frac{b-d}{m}$ subtract $\frac{b}{y}$.
- From $\frac{a+1}{d}$ subtract $\frac{d-1}{m}$.

139. Fractions may also be subtracted, like integers, by setting them down, when the sign of the subtrahend is changed, one after the other, without reducing them to a common denominator.

EXAMPLE.—From $\frac{h}{m}$ subtract $\frac{h+d}{y}$. Ans. $\frac{h}{m} - \frac{h+d}{y}$.

140. To subtract an integer from a fraction, or a fraction from an integer.

Change the sign of the subtrahend, and write it after the minuend; or, put the integer into the form of a fraction, and then proceed according to the general rule for subtraction of fractions.

EXAMPLE.—From $2 + \frac{a}{c}$ subtract $3 + b$. Ans. $\frac{a}{c} - b - 1$.

EXERCISE 20.

- From $\frac{h}{y}$ subtract m .
- From $4a + \frac{b}{c}$ subtract $3a - \frac{h}{d}$.
- From $1 + \frac{c}{d}$ subtract $\frac{c-b}{d}$.
- From $a + 3b - \frac{c}{2}$ subtract $3a - h + \frac{d-b}{3}$.
- From $\frac{a-x}{b}$ take $\frac{d+y}{c}$.
- From $\frac{a+b}{x}$ take $\frac{c-d}{y}$.
- From $\frac{a}{b-x}$ take $\frac{c}{d+y}$.
- From $a - \frac{x}{y}$ take $\frac{3d}{2}$.
- From $x + y$ take $\frac{a-b}{c}$.
- From $\frac{x-y}{10}$ subtract $\frac{a-b}{x+y}$.
- From $x - \frac{4y-2c}{2}$ take $\frac{3x-6y}{3} + a$.
- From $\frac{1}{x}$ subtract $\frac{2}{y}$.
- From $\frac{a^2}{x}$ subtract $\frac{1}{2y}$.
- From $\frac{a^2}{xy}$ subtract $\frac{b^2}{yz}$.
- From $\frac{1}{a^2b^3}$ subtract $\frac{3}{a^2b^3}$.
- From $\frac{1}{x}$ subtract $\frac{1}{x+1}$.
- From $7x - \frac{c^2}{b}$ take $3x - \frac{a^2}{b}$.
- From $\frac{x+y}{x-y}$ subtract $\frac{x-y}{x+y}$.
- From 1 subtract $\frac{x^2-y^2}{x^2+y^2}$.

KEY TO EXERCISES IN LESSONS IN ALGEBRA.

EXERCISE 15.

- $4xy$, $6hmy$, $18cgm$, $3gmy$, $3gmy$, $3gmy$.
- $8dy + 2hx$, $3ad + 3ah$, $3dx + 3hx$, $3dx + 3hx$, $3dx + 3hx$.
- $\frac{a-b}{a^2-b^2}$ and $\frac{a+b}{a^2-b^2}$.
- $\frac{amy}{my}$, $\frac{bmy}{my}$, $\frac{hy}{my}$, and $\frac{dm}{my}$.
- $\frac{adf}{bdf}$, $\frac{bdf}{bdf}$, and $\frac{bde}{bdf}$.
- $\frac{30bx}{10ab}$, $\frac{2xy}{10ab}$, and $\frac{5ab}{10ab}$.
- $\frac{2by}{2y}$, $\frac{2x}{2y}$, and $\frac{cy}{2y}$.
- $\frac{3xyz}{3xyz}$, $\frac{3aby}{3xyz}$, $\frac{9ac}{3xyz}$, and $\frac{ayz}{3xyz}$.
- $\frac{60cx}{20ac}$, $\frac{5ab}{20ac}$, and $\frac{4acx}{20ac}$.
- $\frac{23ay}{23by}$, $\frac{140by}{23by}$, $\frac{224bx}{23by}$, and $\frac{7by}{23by}$.
- $\frac{16a^2c}{4acx}$, $\frac{68acx}{4acx}$, $\frac{4axy}{4acx}$, $\frac{4acx^2}{4acx}$, and $\frac{4acx}{4acx}$.
- $\frac{a}{a^2b^3}$ and $\frac{b}{a^2b^3}$.
- $\frac{ax-a}{x^2-1}$ and $\frac{x^2+x^2+x+1}{x^2-1}$.
- $\frac{x^2-a^2}{a^2+a^3}$ and $\frac{x^2-ax+a^2}{x^2+a^3}$.
- $\frac{30cdx}{60abdef}$, $\frac{40ndf}{60abdef}$, $\frac{45abef}{60abdef}$, $\frac{48abef}{60abdef}$, and $\frac{50abef}{60abdef}$.

EXERCISE 16.

- $a + m + \frac{d}{b}$.
- $m - 1 + dy - \frac{hr}{a}$.
- $\frac{ab+1}{b}$.
- $\frac{ac-b}{c}$.
- $\frac{abx-a+a}{x}$.
- $\frac{mh+dh-md-d^2-r}{h-d}$.
- $\frac{c+a-b}{a}$.
- $\frac{adx+a-b}{d}$.
- $\frac{bd-by-c}{d-y}$.
- $\frac{a^3}{x-a}$.
- $\frac{2x^2-a^2}{x+2a}$.
- $\frac{12ax}{4a-3x}$.
- $\frac{2a}{a+x}$.

EXERCISE 17.

- $\frac{2a}{7b+14}$.
- $\frac{8b+8h}{30a-15m}$.
- $\frac{a^2c^2}{b^2d^2}$.
- $\frac{a^2b^2}{d^2}$.
- $\frac{x^2+a^2}{x^2-a^2}$.
- $\frac{9x^2-13x+4}{x^2-19x+12}$.
- $\frac{1}{168-21a}$.
- $\frac{4}{abcd}$.
- $\frac{4b}{4b}$.
- $\frac{4y}{4y}$.
- $\frac{2x}{2x}$.
- $\frac{3}{4}azy$.
- $\frac{1}{2}bx$.
- $\frac{3c+6x}{2y-4z}$.
- $b+x+m+\frac{e+dx}{a}$.
- $(1) \frac{b}{a}$, $(2) \frac{1}{4y}$, $(3) \frac{x+y}{a+x}$.
- $(4) \frac{axy-ab}{c+bc}$.
- $\frac{adx}{dy}$ and $\frac{cy}{dy}$.
- $\frac{adgy}{bdgy}$, $\frac{bdgy}{bdgy}$, and $\frac{bdgy}{bdgy}$.
- $\frac{ax-b-c}{x}$.
- $\frac{4am+4m-x+y}{4m}$.
- $\frac{2acx}{3dy}$.
- $\frac{abc^2x}{7}$.

READINGS IN GERMAN.—X.

12.—Die Biene.
Dee bee'-nai.

Eine kleine Biene flog
I'-nai kli'-nai bee'-nai floh
Emsig hin und her und sog
Em'-zly hin dant heyr dant zo'ch
Süßigkeit aus allen Blumen.
Zü'-ssy-kite ouss al'-len bloo'-men.
Bienen, spricht die Gärtnerin,
Bee'-yen, shpri't dee gherrt'-nai-rin,
Die sie bei der Arbeit trifft,
Dee zee by dair arr'-bite trifft,
Manche Blume hat auch Gift,
Man'-yai bloo'-mai hat ouch gift,
Und, du suchst aus allen Blumen?
Dant doo zuchst ouss al'-len bloo'-men?
Ja, spricht sie zur Gärtnerin,
Yah, shpri't zee tsoor gherrt'-nai-rin,
Ja, das Gift laß ich darin!
Yah, dass gift lass iy da-rin'!

VOCABULARY.

Biene, f. bee.
Emsig, busily.
Hin und her, to and fro.
Saugen, to suck.
Süßigkeit, f. sweet-ness.
Gärtner, m. gardener.
Manche, many, -a.
Gift, n. poison.

13.—An den Mond.
an dain moant.

Wie schön kommt dort mit freundlich hellem Lichte
Vee sho'n kömt dort mit froint'ly hel'-lem ly'-tai

Der volle Mond daher!
Dair fül'-lai moant da-hey'r!

Wie wiegt im Silberglanz die Pappel und die Fichte
Vee weyt im zil'-ber-glantz dee pap'-pel dant dee fy'-tai

Die schlanken Äste hin und her!
Dee shlan'-ken ess'-tai hin dant heyr!

O welch ein Blick! O welch ein sanfter Schimmer!
O vely ine blick! O vely ine zant'-ter shim'-mer!

Oft hab' ich dich gesehen,
Oft habb' iy dy' gai-zeyn,

Du stiller, guter Mond, und doch bist du mir immer
Doo stihl'-ler, goo'-ter moant, dant doch bist doo meer im'-mer

So neu, so lieb und wunder schön!
Zo noi, zo leep dant vönn'-der-shö'n'!

Wer lehrte dich so abgemessen gehen?
Veyr leyr'-tai dy' zo ap'-gai-mess'-sen ghey'-hen?

An keinem Ort zu früh,
An ki'-nem ört tsoo frü'.

An keinem Ort zu spät hat man dich je gesehen.
An ki'-nem ört tsoo shpeyt hat man dy' yey' gai-zei'-hen.

O Freund! verirrst du dich denn nie?
Oh fröint! ferr-irrst doo dy' den nee?

Gewiß, dich führt ein gültig weises Wesen.
Gai-viss, dy' fürt ine gü'-ty' vi'-zess vey'-zen.

Woh! muß es gültig sein:
Vole moßs ess gü'-ty' zine:

Du leuchtest freundlich ja dem untastbaren Wesen.
Doo loiy'-test froint'-ly yah daim ün'-dank-bah'-ren bö'-zen

Nicht dem Erkenntlichen allein.
Nyt daim. err-kent'-ly'-yen al'-line'.

Und doch geschieht's, daß Menschen, die es sehen,
Dant doch gai-sheets', dass men'-shen, dee ess zey'-hen,

Wie du so freundlich bist,
Vee doo zo hööht'-ri'y bist,

Im Herzen Lieb und Haß, in keinem Lichte sehen,
Im herr'-zen nite dant hass, in di'-nem ly'-tai ghey'-hen,

Auf Rache sinnend und auf List.
Ouf rach'-che zin'-nent dant ouf list.

Ich aber will an dir ein Beispiel nehmen,
Iy ah'-ber vill an deer ine by'-shpeel ney'-men,

Doch Mitle sein, wie du;
Föl mil'-dai zine, vee doo;

Ich will durch Liebe den, der mich nicht liebt, beschämen.
Iy vill döör'y lee'-hai deyu, deyr mly' nyt leep, bai-shey'-men

Und freilich fordern seine Ruch.
Dant freit'-ly för'-dern zi'-nai roo.

Du wirst es sehr von deinem Himmel oben,
Doo virrst ess zeyn fön di'-nem him'-mel o'-ben,

Du hehst dich der Nacht;
Dop höl'-dess lyt dair nacht;

Mit Freude wirst du's sehr und deinen Schöpfer loben,
Mit froi'-dai virrst doo'ss zeyn dant di'-nen shöp'-fer lo'-ben,

Der dich und mich so gut gemacht.
Deyr dy' dant mly' zo goo't gai-macht'.

VOCABULARY.

Mond, m. moon.
Dort, there.
Licht, n. light.
Wiegen, to rock.
Pappel, f. poplar.
Fichte, f. pine.
Schlank, slender.
Nicht, m. bough.
Lehren, to teach.
Abgemessen, measured.
(messen, to measure; ab, prefix, off, away.)
Rein, no.
Ort, m. place, spot.
Je, ever.
Nie, never.
Gewiß, certain, -ly.
Führen, to lead, take.
Gültig, kind.
Weise, wise.
Wesen, n. being, essence.
Leuchten, to shine.
Wise, m. evildoer, devil.
Erkenntlich, grateful.
Allein, alone, but, however.
Geschicken, to happen.
Subtil, gracious.
Neid, m. envy.
Haß, m. hatred.
Rache, f. revenge.
Sinnen, to ponder, think, devise, contrive.
Beispiel, n. example.
Milde, f. mildness, adj. mild.
Durch, through, by.
Den, der, him, who.
Beschämen, to shame, to make ashamed.
Friedlich, peaceful.
(Friede, m. peace.)
Ruhe, f. rest, repose, tranquillity. (Ruhig, quiet.)
Oben, above, upstairs.
Süß, kind, sweet, lovely.
Schöpfer, m. creator.

KEY TO EXERCISES IN LESSONS IN GERMAN.

EXERCISE 130 (Vol. II., page 371).

1. Tell me whether that is your own horse? 2. Have these children much property of their own? 3. Their parents were very rich. 4. I think it very singular that he does not use his own horses, but drives with others. 5. I have no house of my own. 6. Is that his own carriage, or has he only hired it? 7. I consider this question very singular. 8. This is my own conviction, according to which I act. 9. This old merchant is a very singular man. 10. Every man

has his own faults. 11. Have you ever been in this house? 12. I have never been there. 13. I think it my duty not to find fault with him. 14. I shall never deviate from my principles. 15. Have you not been with my brother yet? 16. I have just seen him. 17. Has your daughter already been in my garden? 18. She is not yet gone out. 19. Have you ever travelled over so interesting a country? 20. I have already seen many beautiful things, but I never forget beautiful Switzerland. 21. I have just now again received a letter. 22. Did you arrive so early, that you are already leaving? 23. Do not by any means go too near the fire. 24. By all means come back soon. 25. Yes, I will certainly do it. 26. Do not on any account risk going into the forest without company. 27. I shall certainly be cautious of lending him money. 28. I will certainly see this curiosity. 29. Have you fastened the door well? 30. By all means beware of these people. 31. Pray distinguish truth from falsehood. 32. I have stayed some time at Berlin and at Leipzig. 33. He has hindered me from my work for more than half an hour. 34. My friends think much of me because I do not find fault with any one.

EXERCISE 131 (Vol. II., page 371).

1. Der denkende Mensch weicht nie vom Pfad der Tugend ab. 2. Haben Sie je solch ein reiches Land bereist, als Italien oder die Schweiz? 3. Nein, aber ich werde nie die schönen Thäler des Rheines vergessen. 4. Glauben Sie ja nicht Alles, was man Ihnen sagt. 5. Der Vater kommt so eben mit seinem Sohne und dem Onkel von der Reise. 6. Hält der Lehrer viel von seinen Schülern? 7. Ja, er hält sie für sehr gut. 8. Er hält viel von einem bequemen Leben. 9. Dieser Mensch hält zu viel von seinen Fähigkeiten. 10. Johann ist sein Feind, aber er glaubt, er sei sein Freund. 11. Ich habe ein eigenes Haus, und mein Bruder hat keins. 12. St. dies Ihre eigene Erfindung? 13. Ja, sie ist, aber ich finde diese Frage sehr eigen. 14. Dieser Mensch hat eine eigene Idee. 15. Finden Sie Ihren Freund nicht sehr eigen? 16. Ja, er hält sich über Jermann auf. 17. Sind Sie je im Museum gewesen? 18. Ja, ich bin verschiedene Male dort gewesen. 19. Sind Sie schon in dem Garten meines Oheims gewesen? 20. Um Andern Ruhe zu verschaffen, opfert er seine eigene auf. 21. Meine Freunde hielten mich sehr bei meiner Arbeit auf. 22. Ein Fürst kann sowohl die Gehege seiner Ahnen, als auch seine eigenen verbessern.

EXERCISE 132 (Vol. II., page 372).

1. He that wishes to gain godliness and what is highest in life must not fear work and struggling. 2. He who wishes to win must venture. 3. I prize this book; he who steals it is a thief. 4. He who is resolved to love nothing but his image, has nothing to love but himself. 5. He who doubts, despairs. 6. He that fights against his country is a traitor. 7. He who ventures into danger perishes in it. 8. He who does not assist the oppressed, also deserves no assistance. 9. He who is determined to set himself against fate is a fool. 10. Are you by birth an Englishman or American? 11. I am neither; I am a German by birth. 12. Who is your friend? 13. She is an American, born in New York. 14. Where was your friend born? 15. He is a native of England. 16. In what country were you born? 17. I was born in the United States of North America. 18. I make fun of this man. 19. You should not make fun of him. 20. He makes fun of everybody. 21. There are also fools who laugh at others. 22. This man finds fault with every trifle. 23. It is unwise to find fault with an unimportant thing, or to make oneself merry over it. 24. He who begins too much, accomplishes little. 25. I am delighted with my well-behaved nephew. 26. The Roman Emperor Augustus was in despair over the defeat which Varus had suffered from the Germans. 27. He has spoken to me concerning this object. 28. He who denies obligations to mankind out of love to God, sits in darkness and always holds a looking-glass before him.

EXERCISE 133 (Vol. II., page 372).

1. Der den Armen beisteht, wird göttliche Hülfe erlangen. 2. Derjenige, welcher überall Eingang zu haben wünscht, muß goldene Schlüssel haben. 3. Wer für sein Vaterland streitet, verdient Auszeichnung. 4. Wer Deutsch lernen will, muß sich einige Mühe geben. 5. Wer für seinen König stirbt, stirbt mit Ruhm. 6. Der Hochverrath begehrt, stirbt gewöhnlich auf dem Blutgerüste. 7. Sie sind unter einem glücklichen Sterne geboren. 8. In welchem Lande wurden diese Damen geboren? 9. Sie wurden in Italien geboren, im Jahre 1795; aber ihre Mutter wurde in England geboren. 10. Sind diese Damen aus Deutschland gebürtig? 11. Nein, sie sind aus Frankreich gebürtig. 12. Unser Musiklehrer ist aus Italien gebürtig, und ist in Florenz geboren. 13. Ich werde thun, was ich versprochen habe. 14. Zeigen Sie mir, was Sie gefunden haben. 15. Was den Ruhm dieses Felden erhöht, ist seine Bescheidenheit. 16. Laßt uns ihm gewähren, was wir zuerst verweigerten. 17. Du hast uns nie gesagt, was sie Dir anvertraut haben. 18. Warum machen Sie sich lustig über das Unglück der Unterdrückten? 19. Das Döhl, welches wir in dem Garten unseres Nachbarn sahen, war nicht so gut als das, welches in Ihrem Garten wuchs.

RECREATIVE NATURAL HISTORY.

SHEEP.

It is, perhaps, unnecessary to inform any reader that the sheep family belong to the great and most useful order of ruminants, having, therefore, the same complex digestive system as the oxen and deer. For a description of the fourfold stomach of ruminating animals, we must refer to the paper on the ox family.* Sheep resemble the goats so closely that Baron Cuvier actually classed the two species in one tribe—the *Capridæ*.† The Englishman who compares a goat with a South Down or a Leicester sheep, may marvel much at such a zoological arrangement. But those who have observed the wild goat (*Agagrus*) of the Caucasian highlands, and also the Mouflon, or wild sheep of Southern Europe, will be fully aware of the little difference between the two races. One means of certainly distinguishing the two has of late years been repeatedly noticed; but

this would be of no use to the casual observer. It is simply a structural peculiarity in the foot of the sheep, found in all the domesticated, and in, at least, two of the wild varieties, but never detected in any of the goats. This is a small canal opening at the pastern joint, the true use of which is at present unknown. Some diseases of the hoof arise from this "sac" becoming inflamed by sharp bits of gravel entering the opening. Such a mark may be sufficient to enable an anatomist to distinguish any variety of the

sheep from every kind of goat, but is no guide at all to the traveller, who is unable to institute a minute examination.

One high honour seems to belong to the sheep: it was probably the earliest animal brought under subjection to man, and thus became the first link between the human and the brute creation. Abel was "a keeper of sheep," and the ancient Sabæans exalted this first shepherd to the rank of a deity. The Egyptian divinities, Ammon and Cneph, are represented with rams' heads, the statues of Jupiter Ammon have rams' horns, and the flatterers of Alexander the Great placed the same symbols on the heads of his statues. The starry zodiac does honour to this animal, for almost every one knows the rank which *Aries* (the ram) holds among the constellations. Then we have the mysterious voyage of the Argonauts to recover the famous golden fleece—a story which is yet a puzzle to historian and geographer. Thus, if the sheep has not received the honours of heathen worship paid to the ox, it has been highly exalted by the reverence of early ages.

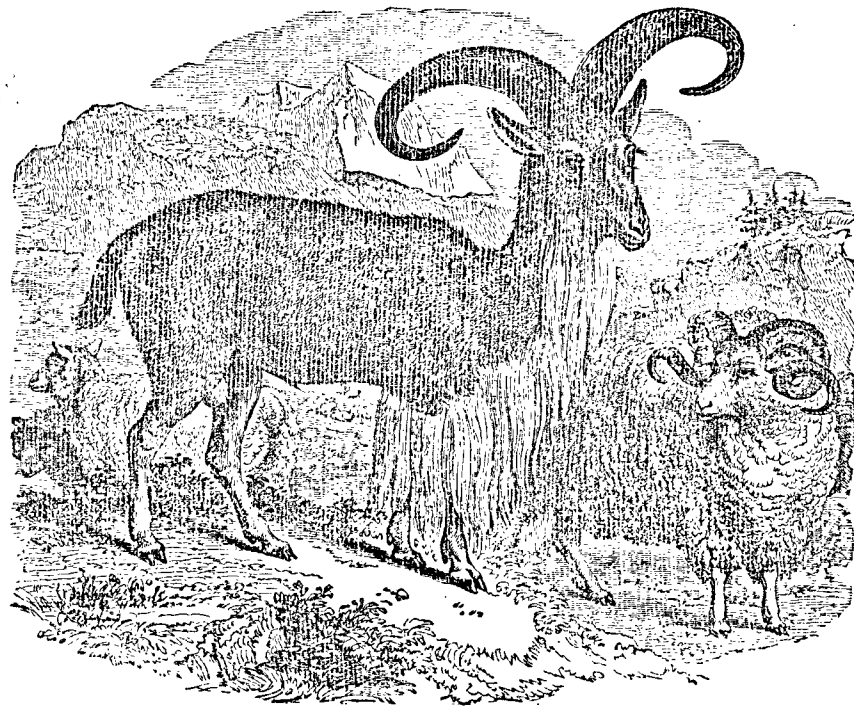
No records enable us to state the period in which these

animals were introduced to Britain. The Romans, probably, brought them to our island, and seem to have even established manufactories for making and dyeing woollen cloths. *Venta Belgarum*, or Winchester, is one of the places where the short wools of ancient Britain were manufactured by Celtic or Latin weavers. Thus, if the Romans massacred the Druids, they favoured sheep and encouraged looms. These primary British sheep are thought to have resembled our present South Downs, upon whose black muzzles and legs we may now look with additional interest.

We must omit, in a paper of this brevity and character, all minute descriptions of the numerous varieties of sheep produced by the care of the scientific breeder, and found in both English and foreign folds. The hornless and long-woolled Leicesters were brought from their original coarseness to their present beauty and value by the perseverance of Bakewell and his successors. The old portrait of the South Down sheep

is by no means attractive, but this variety has now become, by good management, the pet of our Southern and Midland farmers. One hundred pounds of mutton from a two-years' old South Down, and four pounds of good combing wool, may well make this contented and well-behaved sheep a favourite. We say well-behaved, for be it known unto all that some of these animals are by no means the quiet and docile creatures which pastoral poets delight to paint. They will break bounds with the utmost determination and scatter themselves, in par-

ties, far over an open country, driving both dogs and shepherds to their wits' ends. The South Down disdains such conduct, and therefore gives little trouble when pasturing on the open downs of Sussex or Hampshire. The Dorset white-faced and black-horned sheep is called by Mr. Bell "one of the handsomest in any part of England." We are bound, however, in candour to state that beauty, pure and simple, does not form the main attraction of the Dorsets with the farmer, but the early period of the year at which the lambs are ready for the market. Lamb, eight weeks old in December, will fetch no small price from an epicure, and therefore is the Dorset variety prized. The "battle of life" influences the fortunes of sheep and men. The once-esteemed Ryeland breed of Herefordshire, the Morfe variety of Shropshire, and the Tedderly short-woolled sheep of Staffordshire have been unable to answer the calls to produce both abundance of meat and wool. The Leicesters have triumphed in the fierce competition. No nation consumes so much mutton as the English, and so it has come to pass that a sheep producing the finest wool, but little meat, is rejected for one yielding an abundant supply for the butcher, and also a fair quantity of wool, though not the finest. Thus a good South Down, though the wool might only sell for two shillings the pound, would be preferred in England to the once famous Merino, the wool of which might fetch four shillings the pound. The



THE MOUFLON AND THE COMMON SHEEP.

* See page 273 of this volume.

† From *capra*, a she-goat. In such names as *capridæ*, etc., the termination *idæ* denotes relationship: thus, *capridæ* includes all animals related to the goats.

once valued Cotswolds of Gloucestershire have gradually approximated to the Leicesters, and even the hardy and useful Cheviot sheep have felt the influence of the pet breed. We must not stop to describe the former Jersey sheep, said to have had five and even six horns on the head; nor can we perplex the reader by attempting to answer the question, how black sheep originate in a flock. We shall also resist the strong temptation to discuss the evidence for or against a primitive race of black sheep.

But there is a question which cannot be passed over entirely. Do we know the origin of all our domesticated sheep? Most naturalists now agree in tracing all these varieties to the *Mouflon* or *Muscon*, the wild sheep still found in the thinly-peopled regions of Southern and Eastern Europe. The traveller and the hunter may yet meet them in the mountains of Corsica, Sardinia, Crete, and perhaps in the highlands of Murcia. This is a bold and active, though small animal, measuring about three and a-half feet long, and a little above two feet high. The sharply-curved horns are usually about two feet long, and the body is covered, according to Mr. Bell, with a close, short, and fine hair, over which falls the long and coarse wool. Even upon this simple matter there is a dispute. Many naturalists assert that the wool is the short and first covering of the skin, and the long overhanging mass is really hair. This dispute can be settled by the microscope only, and—we must

take Mr. Bell's side in this controversy—the outer covering of the Mouflon is woolly. We must inform the reader that Colonel Hamilton Smith seems to question the Mouflon's claim to be the ancestor of all the common varieties. He regards this wild kind as really descended from individuals of the domesticated sheep, which have at some time escaped from the dominion of man.

Another wild sheep, the *Argali* (*Ovis Ammon*) of Central Asia, is sometimes five feet long, and often possesses horns of an extraordinary size. It appears to have an under-coat of wool and an upper of hair. The *Argali* has an exceedingly wide range, extending from the east of Siberia across the wild uplands of Manchuria and Mongolia to the shores of the Caspian Sea. Some naturalists look upon this as the parent of our domesticated sheep, while others regard it as a variety of the Mouflon. This diversity of opinion proves that we are really ignorant of the primary race.

Africa also has her wild breed of sheep, which are called "bearded," the long hairs depending from each cheek having the appearance of a double beard. The wool of this animal seems to be very short, while over it falls a mass of hair, fourteen inches long.

America, too, has her wild sheep, sometimes called the Rocky

Mountain breed (*Ovis Montana*), having large horns and a long hairy covering. Whether these four wild varieties have been unreclaimed from the beginning of time, is a question not likely to be answered in a satisfactory manner. It may even be questioned whether one or two of the four do not belong to the goat instead of the sheep family. This may prove to be the case when new Cuviers and Owens shall be able to examine more

fully the structure of the *Argali*, or of the bearded sheep. It does not, however, appear very probable that our present classification will be disturbed by discoveries yet to be made.

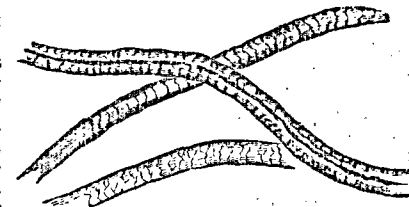
Curious deviations from the usual form are found in some breeds of sheep. The Calmuck variety exhibits two large humps of fat over each hind leg, giving to the animal an appearance at which Europeans laugh. In the Syrian sheep, we have the mass of fat collected in a tail eighteen inches wide.

Observation of sheep in their wild state completely refutes the notion that these animals are a stupid and helpless race. They will find their way up and down precipices inaccessible to human foot, and manage to provide for their subsistence and safety without the care of shepherds and dogs. We know that the domesticated Syrian sheep will answer to its name when called, just like a dog, running out from the flock to the shepherd at his summons.

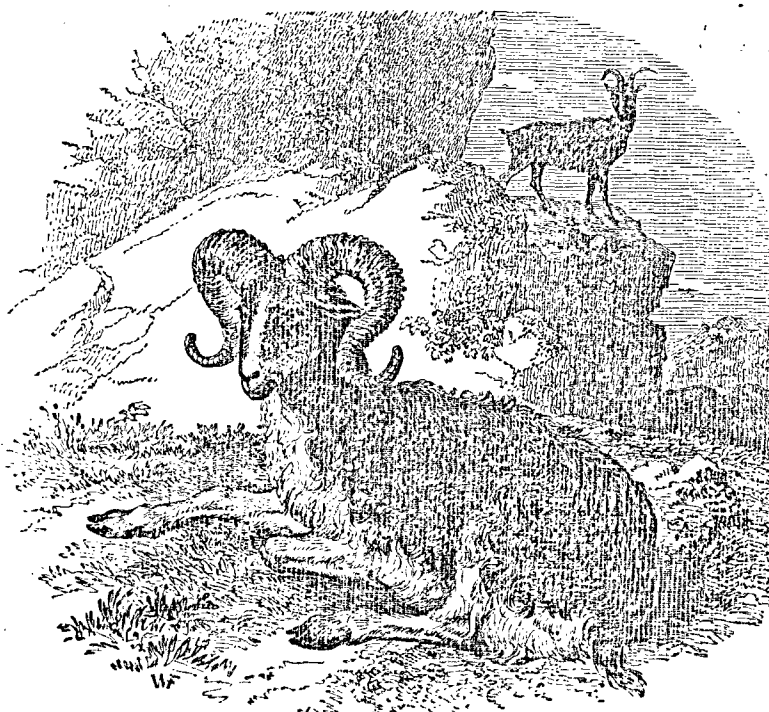
We have already alluded to the double covering of wool and hair on the body of the wild sheep, and a few readers may not

know that the fleeces of our domesticated breeds have hair mixed with the wool. The result of culture is a decrease of the hair and increase of the wool, and the quality of the latter itself is materially changed by the food and training of the animal. The colder the climate the finer and closer is the wool, as a general rule, while in warm regions the hairy covering predominates. All this is in exact accordance with the requirements of the animal temperature. The hair can sometimes be distinguished from the wool in a fleece by the eye only, but the aid of the microscope is usually employed. Under such inspection the peculiar organisation of woollen fibre and its admirable fitness for felting are clearly seen. Let one of our

readers examine for himself a thread of wool, under a strong microscope. He will see that the fibre is not smooth, but marked by a multitude of projections, crossing the thread in zigzag or wavy lines. So numerous are these points that more than 2,000 have been counted on one inch of woollen fibre. The reader will easily understand that, when a mass of wool is beaten together, all these projections act like so many hooks, holding fibre to fibre, and binding the whole into a felt. This peculiar structure of the wool is, doubtless, of use to the sheep, rendering its covering closer than it could otherwise be. But



FIBRES OF WOOL (HIGHLY MAGNIFIED).

THE ARGALI OF CENTRAL ASIA (*Ovis Ammon*).

this property is of such vast importance to man, in the manufacture of clothing, that we may be pardoned for supposing that the Creator had human happiness in view when designing the laws which govern the growth of wool. A fibre of Saxon wool was found to have in one inch about 2,700 of these points; a Merino, 2,400; South Down, about 2,000; and Leicester wool nearly 1,900 in the same space. The corresponding values of these wools for felting purposes were in the exact order of the above numbers. It follows, therefore, that a microscope may be of great use in the wool market.

The wool trade of this country has been marked by a little variety. In the fourteenth century, England exported wool largely to Italy and Flanders, the sheep themselves being also sent to the Continent by thousands. A large amount of the taxes was even paid in bags of wool, which were speedily exchanged for Flemish coins. Repeated attempts were, however, made during the above period to check the exportation of the raw material. Many duties were imposed, and smugglers were punished by the loss of the right hand, which was hung up in the market-places as a considerate warning to all. At length the non-exporters gained the day, and from 1600 to 1825 it was illegal to send a pound of British wool out of the country. A long fight followed; the woollen manufacturers procured a law for burying the dead in woollen cloth, and used all their influence to increase the quantity of wool in the country by the double process of *bringing in* foreign and *keeping in* all the native growth. The great sheep-farmers clamoured for precisely the opposite measures. Could the ovine creatures have comprehended the nature of the battle, they must have felt highly flattered by their influence in English politics. The contest gradually subsided, as wiser commercial views were adopted by all parties.

Though the sheep may not rank as an intellectual animal, it nevertheless largely aided literature in old times. We need but just remind the reader, in passing, that thousands of valuable works must have perished but for the long-enduring parchment, which has preserved the records of past ages.

We ought not to forget the importance of this animal as a religious and knightly symbol. The Divine Teacher of the world employed it as a fit representative of his Church, and the mystical "Lamb" still sets forth to Christendom the one Great Sacrifice. The lamb, bearing the cross, was the ancient symbol of the great order of the Knights Templars, and is still displayed in the Temple Church, London.

If, then, the sheep family be not associated with the grand events of human history, it is sufficiently connected with the civilisation and happiness of mankind to call for some degree of study and reflection.

LESSONS IN ITALIAN.—VIII.

VI.—PRONUNCIATION OF DOUBLE CONSONANTS.

As the proper vibrated sound of double consonants can only be acquired by much steady practice, I have to request my pupils frequently to read aloud the following table, in which I have selected a series of words showing the difference of pronunciation, and, at the same time, of meaning, caused by the doubling of consonants in words, but for this change, identical:—

SIXTH PRONOUNCING TABLE,

Illustrating the Pronunciation of Single and Double Consonants.

Italian.	Pronounced.	English.
Ala	ah-lah	Wing.
Alla	ah-l-lah	To the (tem.).
Ara	ah-rah	Altar.
Arro	ah-r-rah	Earnest-money.
Cane	kah-nai	Dog.
Canne	kah-n-nai	Canes, reeds, tubes.
Caro	kah-ro	Dear.
Carro	kah-r-ro	Car, cart, wagon.
Casa	kah-sa	House.
Cassa	kah-s-sa	Chest, box.
Fato	fah-to	Fate.
Fatto	fah-t-to	Done, made, fact, deed.
Fioco	fee-ko	Hoarse.
Pioco	fee-ko-ko	Flake.
Fumo	fo-mo	Smoke.
Fummo	fo-m-mo	We were.
Gota	gò-tah	Cheek, side.

Gotta	gòt-tah	Gout.
Mulo	moo-lo	Mule.
Mullo	moo-l-lo	Barb (a fish).
Tropo	trò-po	Trope.
Troppo	trò-p-po	Too much.
Pena	pai-nah	Pain, punishment.
Penna	pén-nah	Pen.
Seta	sai-tah	Silk.
Setta	sét-tah	Sect.
Rosa	rò-so	Gnawed.
Rosso	ròs-so	Red.
Seco	sai co	With himself.
Secco	sék-ko	Dryness, dry.
Seno	sai-no	Bosom.
Senho	sén-no	Good sense, intelligence.
Sera	sai-rah	Evening.
Serra	sér-rah	Deile, hothouse.
Sete	sai-tai	Thirst.
Setta	sét-tai	Seven.
Sono	só-no	I am.
Sonno	són-no	Sleep.
Base	báh-zai	Foundations.
Basse	báhs-sai	Low, vile, base.
Mese	mái-zai	Month.
Messe	més-sai	Harvest.
Rosa	rò-zah	Rose.
Rossa	rós-sah	Red (fem.).
Steso	stái-zo	Extended.
Slessa	stés-so	The same.
Abate	ah-bá-tai	Abbot.
Abatte	ahb-bát-tai	He batters down, he abates.
Inseto	in-sét-to	I cover with silk, graft.
Insetto	in-sét-to	Insect.
Invito	in-vé-to	Invitation.
Invitto	in-vit-to	Invincible.
Accesso	ah-tchéi-zo	Inflamed, kindled.
Accesso	ah-tchéi-so	Admittance, access.
Contesa	kon-tái-zah	Dispute, contest.
Contessa	kon-tés-sah	Countess.
Acerra	ah-tchéi-rah	Maple.
Acorra	ah-tchéi-rr-rah	Acerra, a town in Naples.
Anelo	ah-né-lo	I pant, panting.
Anello	ah-nél-lo	Ring.
Ano	ah-no	Anus (in anatomy).
Anno	ahn-no	Year.
Baco	báh-ko	Worm, silkworm.
Bacco	báhk-ko	Bacchus.
Beco	bé-ko	Dominicus.
Bacco	bék-ko	Beak.
Cacio	káh-tcho	Cheese.
Caccio	káht-tcho	I chase, expel.
Capello	kah-pél-lo	Hair.
Capello	kahp-pél-lo	Hat.
Dama	dáh-mah	Lady of rank.
Damma	dáhm-mah	Doe.
Elle	é-lai	Elb, he grows weak, blunt.
Elle	éh-bai	He had.
Fate	fáh-tchai	Torch.
Facco	fáht-tchai	Faces (pl.).
Favi	fáh-vee	Honeycombs.
Favri	fáhv-vee	He does or makes there.
Mira	mee-rah	He looks.
Mirra	mirr-rah	Myrrh.
Tenero	té-nai-ro	Tender.
Tenero	tén-nai-ro	They held.
Vendeta	ven-dái-tai	You sell.
Vendette	ven-dét-tai	Acts of vengeance.
Aceto	ah-tchéi-to	Vinegar.
Acetto	ah-tchéi-to	I accept.
Acopi	ah-kó-pee	Toxic medicines.
Accoppi	ahk-kóp-pee	Thou knockest down.
Acori	ah-kó-ree	Scab, scald.
Accorri	ahk-kór-ree	Thou runnest after, or pursuest
Adito	ahd-dito	Admittance, access.
Adittato	ahd-dí-tah-to	Indicated, shown.
Afato	ah-fah-to	Withered, thin.
Affatto	ahf-fáht-to	Entirely, quite.
Alato	ah-láh-to	Winged, bird.
Allatto	ahl-láht-to	I suckle.
Alletto	ah-lét-to	Allecto, one of the three Furies.
Allato	ahl-lét-to	I allure.
Arcto	ah-né-to	Dill (an herb).
Annetto	ahn-nét-to	I annex.
Anulare	ah-noo-láh-rai	Ring-finger.

* One of the exceptional words, where the s must be pronounced with a sharp, hissing sound, though it is placed between two vowels.

Annulare	ah-noo-láh-rai	To abolish, annul.
Asilo	ah-zé-lo	Asylum.
Assillo	ahs-sil-lo	Horse-fly.
Atene	ah-té-nai	Athens.
Attenne	ah-tén-nai	He kept his word.
Cometa	ko-mái-tah	Comet.
Commata	kom-mét-tah	He may commit (a crime).
Faceta	fah-tchéi-tah	Facetious, droll (fem.).
Facetta	fah-tchéi-tah	Facet (on cut stones).
Roseto	ro-zái-to	Rose-garden, bed of roses.
Rosetto	ros-sét-to	Reddish.

VII.—THE ACCENTS.

I shall now proceed to an explanation of the Italian accents as they are used in Italian writing and printing; for I have already remarked on the accent of tone (an accent not marked in Italian writing and printing), and its primary importance in the enunciation of each word. This is, properly speaking, rather a part of orthography than of pronunciation; but I speak of it here because it is so intimately connected with the rules of pronunciation, and, indeed, with the whole grammar, that I prefer to explain it at the beginning of these grammatical instructions, instead of at the end of them, as grammarians generally do.

1. THE GRAVE ACCENT.

Strictly speaking, there is only one Italian accent, which is the grave accent, marked with a stroke from the left to the right, thus ('). Its use is not left to the discretion of the writer, but is regulated by invariable rules; its omission is therefore an infraction of grammatical laws. A characteristic of this accent is, that only final letters of Italian words can be marked with it. It is placed—

1st. On the last vowel of those words of more than one syllable, the pronunciation of which requires a *very emphatic stress* to be laid on that vowel: as, for example, *pietà* (peai-tah),* piety, pity; *bontà* (bon-tá), goodness; *libertà* (lee-berr-táh), liberty; *carità* (kah-ree-táh), charity; *virtù* (virr-too), virtue; *gioventù* (jo-ven-too), youth; *però* (pai-rò), for that reason, still; *amò* (ah-mò), he loved; *credè* (kra-dái), he believed; *udì* (oo-deé), he heard; *amerò* (ah-mai-rò), I shall love; *così* (ko-sé), here; *costà* (ko-stáh), there; *così* (ko-sé), thus.

2nd. On some monosyllables, where, to avoid ambiguity and confusion, the grave accent is used as a means of indicating the difference of signification. For example:—

With the Grave Accent.	Without the Grave Accent.
À (ah), has (for ha).	A (ah), to (preposition).
Chè (kai), to the end that, or in order that; for (conjunction).	Che (kai), who, which, what, that (conjunction).
Dà (dah), gives, give.	Da (dah), from, by.
Dì (dee), day.	Di (dee), of.
Diè (dee), he gave (for died).	Die (dee-ai), day.
È (é), is.	E (ai), and.
Fè (fai), faith (for fede).	Fe (fai), he did (for fece).
Già (jeh-ah), already, indeed.	Gia (jeh-ah), he went (for giva).
Là (lah), li (lee), there.	La (lah), li (lee), articles and pronouns.
Nè (né), nor.	Ne (nai), a pronoun.
O (ó), I have (for ho).	O (o), or.
Piè (pee), foot (for piede).	Pie (pai-ai), pious.
Sè (sai), a pronoun.	Se (sai), if.
Sì (see), yes, so.	Si (see), a pronoun.

3rd. It is placed on those monosyllables which have more than one vowel as termination, to indicate the necessity of pronouncing them as monosyllables; as, for example: *ciò* (tchò), that, what; *può* (poò), he can; *più* (pee-oo), more; *giù* (joo), below; *qui* (kwé), here; *sì* (see), he is seated (for *siede*).

Other monosyllables offer no ambiguity, and must therefore be considered as naturally unaccented, as they can neither be confounded with other words of the same spelling, nor can their

* For the sake of consistency of system, I shall not deviate, in these cases, from my usual practice of marking every syllable which has the accent of tone by the acute or circumflex sign. The reader will, of course, understand that these are mere arbitrary signs used for the purpose of instruction, and which must not be imitated when he may have occasion to write words requiring the grave accent.

† This is another of those exceptional words where the s must be pronounced with a sharp, hissing sound, though it is placed between two vowels. It is obvious, from its meaning, that, like *cosa* (kò-sah), thing, it is of the most frequent occurrence.

pronunciation offer any difficulty. To mark these, as is sometimes done, with a grave accent, merely because they are monosyllables, is not only a grammatical fault, but useless, serving no purpose whatever, and encumbering Italian writing with superfluous signs; for example: *re* (rai), king; *fu* (foo), was; *gru* (groo), crane; *su* (soo), above; *ce* (tchai), us, here; *ma* (mah), but; *mo* (mò), now; *no* (nò), not; *so* (sò), I know; *me* (mai), me; etc.

Of the monosyllable *qua* (kwah), here, it may be remarked that it is more frequently written without than with the grave accent, and of *stè* (stè), he stood (for *stette*), that being an abbreviated word, it is always written with the grave accent.

I shall terminate these remarks on the grave accent with two important rules, of very frequent application in Italian grammar.

1. When any monosyllable, written with the grave accent or unaccented, or when any word of more syllables than one, having the grave accent on its final vowel, is joined to another word so as to make a compound with it, the initial consonant of the latter word (unless an s with another consonant to follow) must be strongly vibrated in pronunciation, and therefore doubled in writing, and the grave accent of the first word taken off. For example:—

È (è), is, and *vi* (vee), there = *ervi* (év-vee), there is.
Più (pee-oo), more, and *tostò* (tò-sto), soon = *piuttostò* (pee-oo-tò-sto), sooner, rather.
Già (jah), indeed, and *mai* (mahee), never = *giamai* (jahm-máhee), never.
Dà (dah), give, and *mi* (mee), to me = *dammi* (dáh-m-mee), give me.
Fa (fah), do, and *mi* (mee), to me = *fammi* (fáh-m-mee), do me.
Amò (ah-mò), he loved, and *la* (lah), her = *amolla* (ah-mòl-lah), he loved her.

Farò (fah-rò), I shall do, and *lo* (lo), it = *farollo* (fah-ròl-lo), I shall do it.

Fra (frah), between, and *tanto* (táhn-to), so much or so long a time = *frattanto* (fráh-táhn-to), in the meantime.

Da (dah), from, and *lo* (lo), the = *dallo* (dáh-l-lo), from the.
Su (soo), upon, and *lo* (lo), the = *sullo* (soòl-lo), upon the.

2. Monosyllables, though naturally unaccented, must be marked with the grave accent when, as last syllables of a compound, they are joined to participles or other words. For example:—

Per (per), through, and *che* (kai), which = *perché* (perr-kái), why because.

A (ah), to, and *do* (dó), I give = *addò* (ahd-dó), I apply myself to.

Contra (kón-trah), against, and *fo* (fó), I make = *controffò* (kon-tráh-fó), I counterfeit.

Ri (ree), a particle, and *ho* (hó), I have = *rihò* or *riò* (ree-ó), I have or get again.

Ri (ree), a particle, and *so* (sò), I know = *riò* (ree-sò), I know by hearsay, I learn.

Sopra (só-prah), upon, and *sto* (stó), I stand = *soprastò* (so-pra-stó), I am above.

Tras (trahs), a particle, and *vo* (vó), I go = *travò* (trahs-vó), I pass beyond or exceed.

Qua (kwah), here, and *su* (soo), above = *quassù* (kwahs-soó), up here.

Mai (mahee), never, and *no* (nò), not = *mainò* (mahee-nò), no, not at all.

Oi (oe), ah! alas! and *me* (mai), me = *oimè* (oe-mái), alas! unhappy me!

Vice (vée-tchai), substitute, and *re* (rai), king = *vicere* (vee-tchai-rái), viceroy.

And so all the numerous and similar compounds of *che*, the compounds of *su*, and of the verbs *do*, *fo*, *ho*, *so*, *sto*, *vo*, etc.

LESSONS IN MUSIC.—XIX.

MENTAL EFFECTS OF TE AND RAY (continued).

We must now ask our pupils to diligently study the three following tunes—"Cyprus," "Spanish Chant," and "Clifton Grove"—in order to recognise perfectly and familiarly the mental effects of TE and RAY.

It will be encouraging to those who have faithfully followed our course thus far, to know how much of the journey they have yet to travel. The present lesson will be followed by one on the varieties of the human voice—pitch, quality, strength, force, etc.—which will be illustrated by several songs arranged for three voices. Next will come a lesson on the deeply-interesting subject of transition or "modulation," illustrated by several short pieces arranged for four voices. The subject of "minor" tunes and the "minor scale" will follow.

EXERCISE 33.—CYPRUS. KEY A. M. 80.

s₁ d : - t₁ | d : r m : f | s : m r : - d | r : m d : - | - s₁
 A-las! what se-cret tears are shed, What wound-ed spi-rits bleed; What
 m₁ m₁ : - f₁ | m₁ : s₁ d : - r | m : d t₁ : - d | s₁ : f₁ m₁ : - | - m₁

d : - t₁ | d : r m : - f | s : m r : - d | r : m d : - | - s₁
 lov-ing hearts are sun-der-ed, And yet man takes no heed! He
 m₁ : - f₁ | m₁ : s₁ d : - r | m : d s₁ : - l₁ | t₁ : s₁ d : - | - d

s : t₁ | t₁ : r r : d | d : t₁ l₁ s₁ : d | d : r m r : - | - s₁
 go-eth in his dai-ly course, Made fat with oil and wine; And
 t₁ : r₁ | r₁ : f₁ f₁ : m₁ | m₁ : f₁ m₁ : m₁ | d : t₁ d s₁ : - | - s₁

d : - t₁ | d : r m : - f | s : m r : - d | r : m d : - | - s₁
 pit-ied not the wea-ry souls That in his bond-age pine.
 m₁ : - f₁ | m₁ : s₁ d : - r | m : d s₁ : - l₁ | t₁ : s₁ d : - | - d

EXERCISE 34.—SPANISH CHANT. KEY B FLAT. M. 66.

d : - t₁ | d : r m : - f | s : m r : - d | r : m d : - | - s₁
 Far, far o'er hill and dale, Green woods are chang-
 m₁ : - f₁ | m₁ : s₁ d : - r | m : d t₁ : - d | s₁ : f₁ m₁ : - | - m₁

d : - | m : - r : m | f : m r : - | m : - r : m | f : m
 ing, D.C. ing, And o'er the smil-ing land, Fruits as the count-less
 m₁ : - | d : - t₁ : d | r : d t₁ : - | d : - t₁ : d | r³ : d

r : - | d : - t₁ : d | l₁ : d s₁ : - | m : d f : r | d : t₁ d : -
 sand, God pours from o-pen head, With love un-chang-ing.
 t₁ : - | m₁ : - r₁ : m₁ | f₁ : f₁ m₁ : - | s₁ : m₁ l₁ : f₁ | m₁ : r₁ m₁ : -

EXERCISE 35.—CLIFTON GROVE. KEY C. M. 100.

s d¹ : - : d¹ | d¹ : - : s l : - : s | s : - : s d¹ : - : d¹ | r¹ : d¹ : r¹
 The sun is down, the day gone by, The stars are twink-ling
 m m : - : m | m : - : m f : - : m | m : - : m m : - : m | f : m : r

m¹ : - : d¹ | d¹ : - : m¹ f¹ : - : f¹ | m¹ : - : m¹ r¹ : m¹ : d¹ | t : - : l s
 in the sky; Nor torch nor ta-per long-er may Eko
 d : - : m | m : - : s l : - : f | d¹ : - : d¹ s : m : l | s : - : f m

l : s : f | m : f : s l : - : s | s : - : l t d¹ : - : s | d¹ : - : s
 out a blithe but stint-ed day. The hours have passed with
 f : m : r | d : r : m f : - : m | m : - : f m : - : m | m : - : m

l : - : s | s : - : s d¹ : - : d¹ | r¹ : - : m¹ : f¹ m¹ : - : d¹ | d¹ : - : r¹ m¹
 stealth-y flight; We needs must part, Good night, good night, The
 f : - : m | m : - : m m : s : d¹ | t : - : d¹ : r¹ d¹ : - : d¹ | d¹ : - : d¹

f¹ : - : f¹ | m¹ : - : m¹ r¹ : m¹ : d¹ | t : - : l s l : s : f | m : f : s l : - : s | s : - :
 hours have passed with stealth-y flight; We needs must part, Good night, good night.
 t : - : t | d¹ : - : d f : - : f e | s : - : f m f : m : r | d : r : m f : - : m | m : - :

We now give our readers the continuation of the words that may be sung to the Exercises in the preceding pages, those to "Cyprus," Exercise 33, being from the pen of Mrs. Mary Howitt:—

2. To him they are but as the stones
Beneath his feet that lie,
It entereth not his thoughts that they
From him claim sympathy;
It entereth not his thoughts that God
Heareth the sufferer's groan,
That, in his righteous eye, their life
Is precious as his own.

The following are the second and third verses of the words to the "Spanish Chant," Exercise 34:—

2. See to the harvest field
Gleaners have hasted,
Gathering the scattered ears,
None should be wasted.
FREELY WE ALL RECEIVE,
FREELY THEN WE SHOULD GIVE,
On Him "in whom we live"
All our care casting.
3. Spring came and passed away,
Summer is ending;
Autumn will soon decay,
With winter blending.
While time is given us here,
Oh, may we prize it dear,
In love and godly fear
Each moment spending.

The following additional verses are to be sung to the air called "Clifton Grove," Exercise 35. The words to this Exercise were written by Joanna Baillie:—

2. The lady in her curtained bed,
The herdsman in his wattled shed,
The clansman in the heathered hall,
Sweet sleep be with you, one and all!
We part in hopes of days as bright
As this gone by; good night, good night!
3. Sweet sleep be with us, one and all!
And if upon its stillness fall
The visions of a busy brain,
We'll have our pleasure o'er again,
To warm the heart! to cheer the sight!
Gay dreams to all! good night, good night!

MECHANICS.—XI.

THE MOMENTS IN THE LEVER OF FORCES.—THE WHEEL AND AXLE.—THE COMPOUND WHEEL AND AXLE.

We now return to Mechanics pure and simple, applying the geometrical principles enunciated in previous lessons to determine

THE MOMENTS IN THE LEVER OF FORCES NOT PARALLEL.

Two such forces, A , P , Q (Fig. 60), being supposed to meet at some point, A , to which they are transferred, and there compounded into a resultant $A R$, represented by the diagonal of the

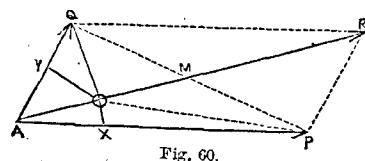


Fig. 60.

parallelogram, $A P R Q$, and O being a point taken at random on that diagonal, we can prove the following very important proposition:—

The moments of two intersecting forces in reference to any point on their resultant are equal to each other.—Now the moment of a

force in reference to a point, as has been already explained, is the product of the force by the perpendicular dropped on it from that point. In Fig. 60, therefore, the moment of A in reference to O , a point on the resultant, is $A P$ multiplied into $O X$, the perpendicular from O on $A P$. So likewise is the moment of $A Q$ in reference to O equal to $A Q$ multiplied into $O Y$, the corresponding perpendicular. What I have then to prove is that these products are equal. But they are equal; for, from the second geometrical principle above, the areas of the triangles $A O P$, $A O Q$, are half these products; and, by the third, since these triangles stand on the common base $A O$, and the line $P Q$ joining their vertices, being a diagonal, is bisected by $A R$, that is, by that base, their areas are equal. The moments of $A P$ and $A Q$, therefore, in reference to O are equal, as I undertook to prove.

Now, to apply this to the lever, using the same figure, let us suppose the two forces to be $A P$, $A Q$, meeting, as I have stated to be necessary, at some point A . Then it is evident, since there is but one point fixed in the body, that there cannot be equilibrium unless the resultant of $A P$ and $A Q$ passes through that point, and is there resisted by the supports that fix it. The fulcrum, therefore, you see, must be on the resultant, and therefore taking O to be the fulcrum, we must have $A P$ multiplied into $O X$ equal to $A Q$ multiplied into $O Y$, that is, the moments of the forces in reference to the fulcrum must be equal. We arrive thus at the two following modes of stating the condition of equilibrium in a lever, either of which may be selected for use as the occasion requires:—

1. In a lever, the forces not being parallel, the power multiplied by the perpendicular from the fulcrum on its direction is equal to the resistance multiplied by the perpendicular on its direction.
2. The power and resistance are to each other inversely as the perpendiculars dropped from the fulcrum on their respective directions.

THE WHEEL AND AXLE.

This useful mechanism, of which several forms are given in Figs. 61, 62, and 63, is a kind of lever, or succession of levers, revolving round an axis, from which they project at right angles.

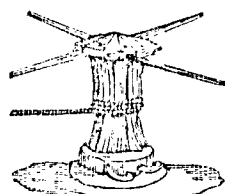


Fig. 61.

Corresponding to this central axle line is a cylindrical axle of some thickness, round which winds the rope which bears the resistance, or weight, to be raised. In Fig. 61 is the simplest form of the instrument, consisting of an horizontal axle and four levers, which are worked in succession by the power. In the ship's capstan for raising the anchor (Fig. 62), the resistance acts horizontally, a man pushing also horizontally

at the end of each lever, the power being multiplied in the proportion of the number of levers and men. We have in Fig. 63 another form, where the levers are the spokes of a wheel, and the power A works in succession on them along the tire as they come round.

The principle in all is the same, whether the resistance and power be parallel or not, and may be understood from Fig. 64, which represents a transverse section, the outer circle being the wheel and the inner the axle. The central line of the axle, which you must conceive perpendicular to the paper at the centre of these circles, is the fulcrum, represented by the point O . The line $A B$ thus is seen to be the lever, at the ends of which the power, P , and resistance, W , act; and, as already proved, these forces must be inversely as $O A$ to $O B$, which lines are the radii of the wheel and axle respectively. When the power and resistance act parallel to each other this is evident; but the same holds good were they not so to act, as in the capstan, where the power is continually changing direction as the sailors go round; for, referring again to Fig. 64, if the power were to act not in the

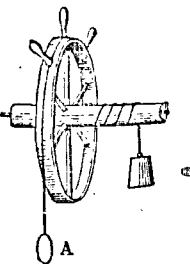


Fig. 62.

line $A P$, but along any other tangent to the large circle, the perpendicular from the fulcrum O on its direction would still be the radius of the wheel; and, by the general principle of the lever established in this lesson, the power and resistance would be still inversely as the radii of wheel and axle.

A treadmill, used for punishment in prisons, is another instrument of this kind, the power being the weight of the prisoners ascending the steps placed on the outside of the wheel, and the resistance the weight of the water pumped, the corn ground, or other work done. The windlass is another, turned generally by a winch handle, and used to raise water from wells, or lift goods into stores. In Fig. 21 (page 152) the reader will find an example of the utility of the wheel and axle as a mechanical power in the crane, by which two men, by turning the winch-handle attached to the axle, are able to lift a horse out of the steamer alongside of the quay.

A particular form of the windlass, which was first invented in China, and which may therefore be called the "Chinese windlass," is given in Fig. 65, where only the axle is represented, consisting of two parts, one thicker than the other, but both forming one solid piece. The winch handle, or wheel, is to the right connected with the larger axle. The weight to be raised is suspended from a hook attached to a pulley, round which the lifting rope passes, one part winding round the thick axle while the other unwinds from the thin. The weight with each turn of the wheel ascends by the difference between the length of the rope that winds and unwinds, that is, by the difference between the circumferences of the two axles. Moreover, since the weight is equally divided between the two ropes which ascend from the pulley, the force acting at the circumference of each axle is half the weight.

It is evident, moreover, that the power applied to the winch handle has to balance the difference of the actions of these forces at the axle, or the moment of the power must be equal to the difference of the moments of these forces. But each force being half the weight, its moment is half the weight multiplied by the radius of the axle at which it acts; and therefore their difference is equal to half the weight multiplied by the difference of the radii of the axles, or, which comes to the same thing, to the weight into half the difference of these radii. But the moment of the power being that force into the radius of the wheel, we immediately learn that—

In the Chinese windlass the power multiplied by the radius of the wheel is equal to the resistance multiplied by the difference of the radii of the axles.

THE COMPOUND WHEEL AND AXLE.

This is a combination of wheels and axles, of the kind already explained, made for the same purpose as the similar combination of levers in Lesson IX., namely, the mechanical advantage of a multiplication of the effect of the power. The wheel and axle being once clearly understood to be a lever, there can be no difficulty in extending the rule which holds good of the compound lever to this combination. In Fig. 66 is such a combination. By

cogged teeth the axle of each wheel works on the circumference of the next succeeding, the power, P , being applied by a rope to the circumference of the first wheel, which does not require teeth. It is evident that, as explained of the compound lever, the condition of equilibrium must be that—

In the compound wheel and axle, the power is to the resistance as the product of the radii of the axles is to the product of the radii of the wheels.

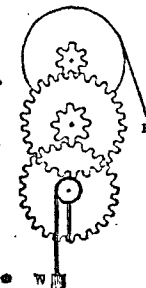


Fig. 63.

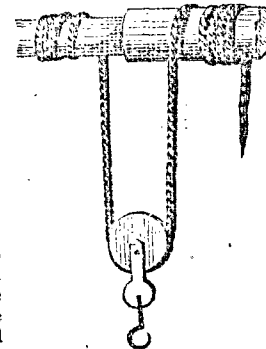


Fig. 64.

LESSONS IN GEOLOGY.—VIII.

ATMOSPHERIC, ORGANIC, AND CHEMICAL AGENCIES.

THE direct action which the atmosphere exercises in the alteration of the earth's crust is through the agency of wind. The atmosphere also acts widely and continually upon rocks, attacking them chemically; but this action must be reserved for its proper place. The power of wind can only be felt by movable particles—that is, by sand. As the winds sweep over the deserts, they urge before them clouds of fine sand, which drift here and there, continually altering the features of the landscape, and extending the desert domain by covering the fertile tracts which border on the sandy waste. But the changes which occur in such regions are of little or no moment, for the absence alike of water and vegetation precludes the possibility of these sand-hills ever becoming fixed. But this is not the case with that belt of sand which lines the coasts of many maritime countries. Here considerable and permanent changes are effected by the alteration of the sand dunes by the wind. The shores of the Bay of Biscay are celebrated for these dunes; the wind blows the particles of sand over the crest of the hill in constant succession, and thus the hill is moved. The dunes of Biscay often advance sixty or seventy feet in a year, covering with irresistible encroachments farms and villages, and are sometimes as much as 300 feet high. In many parts of the world this process is in action. When a covering of vegetation springs up on the surface of the hill, all further advancement is prohibited, and the dune becomes permanently fixed. Such hills are distinguished by the name of *sub-aerial* or *Eolian* accumulations (so called from *Eolus*, the god of the winds, according to the old Greek and Roman mythology).

Frost is generally reckoned an atmospheric agent. Its power is very great, and it would be difficult to limit the geological work it effects. When water freezes, at the moment of its solidification it expands, with an almost irresistible force, one-tenth of its volume—that is, ten measures of water, when frozen, would become eleven measures of ice. The first frost of winter solidifies all the particles of water with which the rocks are soaked, forcing the particles of rock from each other, and when the thaw comes, much of its surface crumbles down. This action is not very visible, because the rain easily transports the fine particles thus separated from the mass. Yet when we consider the vast surface which is annually exposed to a temperature below freezing point, we shall have some idea of the great effect which frost has in assisting the general degrading action which the surface of the earth is ever undergoing; and our estimate will be increased when we know the force which is exercised by the solidifying ice. If a hole be bored in a cannon-ball, then filled with water and plugged with a fine-threaded screw, upon causing this water to freeze by immersing the ball in a freezing mixture, the expansive force will be found sufficient to break the ball. In the Canadian forests, often the stillness of the night is broken by a loud report, as some giant tree is rent by the united power of the watery particles expanding on their solidification, under the influence of the first frost of winter.

Frost also acts geologically by means of *avalanches*, *glaciers*, and *icebergs*.

An *avalanche* does not play a very prominent part, seeing the sphere of its action is very limited. When large masses of ice and snow collect on the inaccessible heights, and become either overbalanced by their own weight, or loosened by the warm sun of the spring, the mass falls into the valley beneath, bearing with it rocks, etc.; and the traveller, as he passes through the mountain valleys in Switzerland, often finds piles of *débris* which have been brought down by an avalanche from the heights above. This the valley stream carries down into the lake or river, and thus material from the summit of the chain mingles with the sediment which the stream erodes from the valley through which it passes. It occasionally happens that an avalanche in its fall dams up the channel of a stream; the pent-up waters gather in great volume, and at last burst their barrier, ploughing the valleys in their course, thus doing great geological work.

Glaciers are some of the most interesting features of Alpine scenery. They are, in fact, *rivers of ice*, not frozen rivers. But vast quantities of ice, which is formed amid the eternal snows, and by a peculiar motion, known as that of a viscous body, descends down the valleys until it reaches such a point

that the temperature melts the ice. Thus glaciers are, in fact, overflow-channels, by which the accumulation of snow, which is continually increasing above the snow-line, discharges itself. Were it not for the glaciers, the snows would increase without any limit, and the summits of elevated mountain-chains would be an anomaly in nature—continual recipients of condensed and frozen aqueous vapour, without any means of giving it off again. Many of the Swiss glaciers are thirty or forty miles long, in some places as much as three miles wide, and often 600 feet thick. The cause of their motion was for many years a subject of debate. Many theories were broached only to be refuted. The discovery of what is believed to be the true explanation of the motion is due to Principal J. D. Forbes. He carefully measured the progress of the different points of the glacier, and found that its flow corresponded very closely to that of a river. The motion was greater in the centre than at the sides, and at the surface than at the bottom. It did not vary day or night, and therefore whatever might be the cause of its motion, that cause resided in itself, and did not depend on any external circumstances. All theories had hitherto looked for some motive power either in gravitation, or the expansion of the ice, consequent on the heat of the sun, and its clinging to the sides of the valley prevented a return to its former position, and so it crept down to the lower regions. However, Forbes showed that ice is a viscous or plastic body, capable of yielding to great pressure, so that the mass of ice on the incline of the mountain slope flowed downwards. But although ice in one sense is not viscous—that is, it cannot bear a strain, and will not allow itself to be pulled out into threads—yet it possesses another remarkable property which compensates for this. When two pieces of ice are pressed together, they freeze to each other. They will even do this in warm water; so that when the glacier comes to a narrow part in the valley, it does not refuse to pass the projecting point, but the enormous pressure behind forces it through, the ice breaking to accommodate itself to its constrained position, and then joining anew. After the narrow place is passed, the glacier spreads out again just as a river would do, and again occupies the whole of the valley. Most glaciers progress at the rate of 400 or 500 feet a year. The termination always occupies much the same position, though in winter the glacier comes down further into the valley. Yet in summer it is melted off. As the ice-river flows down from the heights, it brings rocks and debris which fall upon it as it tore the flanks of the valley. These lines of rocks are termed in Switzerland *moraines*. When two valleys meet each other, their glaciers unite; one of the lateral moraines of each joining together become the *medial moraine* of the main glacier. By this means boulders are brought down from the inaccessible heights, and piled up in huge heaps at the termination of the glacier. The rocks of the valley over which the ice passes are all smoothed and scratched, thus indicating the direction in which the glacier flowed. We shall find many rocks exhibit this grooving, thus telling of the existence of a glacier many ages after the last vestige of the ice had melted.

Icebergs.—When there are glaciers in the Arctic regions, it is evident that they can never melt, the snow-line being at the sea-level. Therefore the flow continues until the sea is reached, and then as the glacier proceeds over the coast cliffs, enormous blocks of ice fall into the sea and are borne away; but these bergs carry on them part of the glacier moraine, and by this means the fragments of the rocks of the Northern regions are dropped in warmer seas, where the berg melts. Of this operation we shall find many illustrations in the Pleistocene epoch.

THE ORGANIC AGENCY.

It is difficult to realise the prominent part which life has played in the formation of rocks. We do not allude only to the beds of coal which represent the forest growth of vast lapses of time, but to the limestone rocks and many of the siliceous deposits. The reader may be aware that chalk or carbonate of lime is not soluble in water, but it becomes so if carbonic acid gas be present. Now Bischof states that there is so much of this gas in sea-water, that five times more chalk could be contained in it than it at present holds in solution. Hence it is evident that no chalk could ever be precipitated from the sea in the ordinary manner. How, then—presuming the present state of the sea to have existed with but slight alteration in past ages—can the deposition of the chalk and limestone rocks

be accounted for? It is of little avail to assert that the cretaceous seas were overlaid with chalk. They could only have been so by wearing down some already existing chalk cliffs, so that the difficulty is not solved, but only placed back in an earlier period. The solution is offered by our observing the great accumulation of chalky material which composes the coral reefs. The coral zoophyte has, in common with all shell-fish, the power of separating from the sea-water its carbonate of lime, with which it builds its domain. It is in vain to attempt to conceive the number of these little animals on one reef; and yet there are reefs on the Australian coast 1,000 miles long, and from ten to ninety broad! The "bottom" around these reefs was found to be covered sometimes with broken shells, but in other places with fine mud, which proved, on microscopic examination, to be minute foraminifera. Several similar accumulations have been discovered to be in progress in many other parts of the world. From these facts, and from an examination of the chalk itself, which reveals under the microscope many thousand perfect shells in a cubic inch, the conclusion is drawn that the limestone rocks have been built up by the agency of living creatures.

Professor Ehrenberg, of Berlin, was the first to turn the attention of the geological world to the accumulation of matter by minute organisms. He examined the tripoli, or polishing slate, which occurs near Bilin, in Bohemia, in beds many fathoms thick and many miles in extent, and found it to be wholly composed of the siliceous coverings of organic beings. They are so minute that, in a single grain of the tripoli, there are no fewer than 187 millions of individuals! It is still a disputed point whether these are animal or vegetable organisms. Those who place them in the animal kingdom term them *Infusoria*, because they are generated in any infusion which is left undisturbed for some time. Those naturalists who believe in their vegetable origin call them *Diatomaceæ*. From the Berlin Professor we learn that, in the harbour of Wismar in the Baltic, no less than 17,946 cubic feet of these siliceous organisms are produced annually, though it takes 100 millions of them to weigh a single grain! However, their extreme minuteness is in some measure compensated by their extraordinary power of production. "A single one of these animalcules can increase to such an extent during one month, that its entire descendants can form a bed of silica twenty-five square miles in extent and a foot and three-quarters thick!" The mountain-meal of the Swedes and the edible clay of the North-American Indians are accumulations of this kind. From these remarks, probably, the reader will gather some idea of the geological organic agent.

THE CHEMICAL AGENCY.

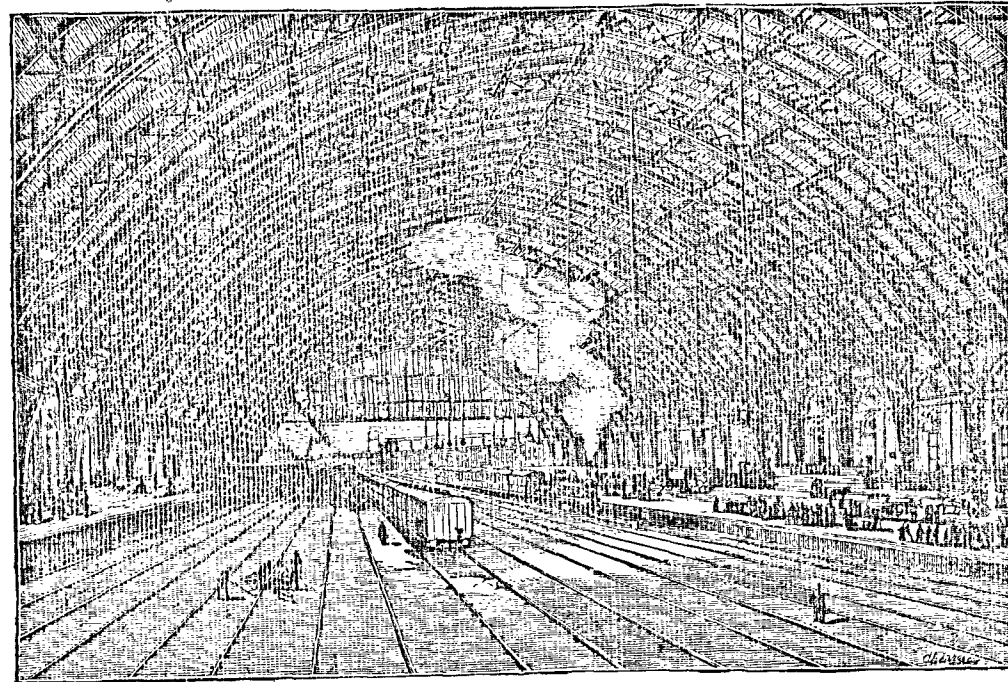
The chemical agent is not great in accumulating, but it would be impossible to over-estimate the work which this power does in altering the earth's surface.

First, the gases in the atmosphere—that is, the oxygen and the carbonic acid—are constantly employed in *weathering* rocks—that is, in attacking the exposed surface, and so affecting it as to render it capable of being acted on by the rain and gradually worn away. The most casual examination of any old building or long-exposed rock will show this.

Deposits from mineral springs may fairly be considered a chemical result. In all volcanic countries this species of deposition is carried on to some extent. In Italy the well-known building stone, *travertine*, or Tiber stone, is of this kind of deposit. This is the stone of which the Coliseum is built. The Carlsbad springs, it is calculated, produce 200,000 cubic feet of calcareous matter every twenty-four hours.

Stalactites and stalagmites are formed on much the same principle. The water is charged with carbonate of lime, which is held in solution by the presence of free carbonic acid gas. When this water drops from the roof of a cavern, the gas escapes, and the water being no longer capable of supporting the carbonate of lime, deposits it, forming a stalagmite, an icicle-like pendant from the roof.

All saline deposits are to be ascribed to chemical agency, such as the beds of sulphate of lime, the layers of common salt, the deposits of nitrate of soda and potash. Under this head also some geologists would class all such exudations as petroleum or rock-oil. We shall treat of these various materials more particularly when we speak of the formations in which they severally occur.



TERMINUS OF THE MIDLAND RAILWAY, ST. PANCAS.

LESSONS IN ARCHITECTURE.—XVII.

RAILWAY ARCHITECTURE.—III.

HAVING described the chief features of a railway line, with its viaducts, etc., we come now to its stations and terminal points. Here we find endless variety in construction, according to the wants of the traffic and the means available for the work. Common railway stations of brick or wood differ so little from ordinary buildings as to require no particular comment; but the use of iron has given rise to some distinctive features in railway architecture, quite as striking in their way as the bridges before described.

Commencing with the simplest forms of construction in which iron is the material employed, we give in the annexed engraving an illustration of the framework of an ordinary station available for the stoppage of trains. The walls of the building consist of iron pillars more or less ornamental, and either entirely open at the sides, or with the spaces between the pillars filled in with brickwork, etc.

It is in the formation of the roof that the skill and knowledge of the architect are especially displayed, it being necessary to combine durability with lightness, and the greatest possible saving of material with perfect strength in the structure.

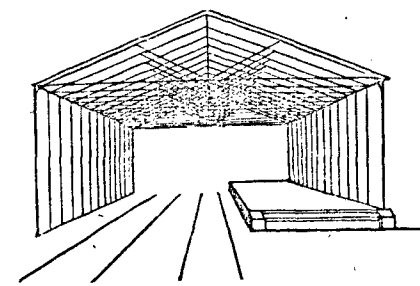
In the ridged roof before us, rods of wrought iron, called the *tie-beams*, are placed horizontally from the pillars on one side to those on the other, and serve as a support for the rafters which form the roof, as well as to tie or bind the walls in their proper position. The apex of the roof, formed by the meeting of the rafters, is supported by vertical rods of iron called *king-posts*, which are securely fastened to the tie-beams below. To give additional support to the roof, and to relieve the sides of the building from too great pressure, other rods, termed *struts*, are fixed diagonally between the bottom of each king-post and the

roof above, as seen in the illustration. Thus the weight of the roof is divided between the pillars at the sides and the tie-beams which run across, and the different members of the truss or framework mutually support each other. The meeting-points of all the rods are provided with plates and sockets, which are fastened with bolts and nuts.

A similar method is adopted in the construction of all roofs of the ridged form, whether the material be wood or iron, and the chief portions of the truss always bear the names here mentioned. More complicated arrangements are frequently seen, double rafters and additional struts or braces being employed; but in ridged roofs of larger dimensions the general principles of construction are in all cases the same.

In some of the more important stations, and especially in the termini of our principal lines, the arched form of roof is frequently employed; and in some instances, as in the termini of the Great Northern and Midland Railways at King's Cross and St. Pancras, these roofs are of great span and proportions. We will first describe the structure forming the terminus of the Great Northern. This roof is supported by large semi-circular girders, formed of battens of wood jointed by iron bolts,

and crossed transversely by horizontal iron rods, which complete the framework for the covering. As an example of the use of wood in this form, this station is very remarkable; but in later constructions of the same kind, iron has quite superseded the other material, and in the reconstruction of the roof wrought iron was mainly employed. Massive plates, formed in segments of a circle, are bolted together, and thus are formed roofs of the largest span and the most durable character. It is a fundamental principle in the construction of all roofs, that their weight should be so disposed as to exert only a vertical pressure upon the walls, and not in any degree a force that



FRAMEWORK OF AN ORDINARY IRON RAILWAY STATION.

Asiatic in a lesser degree, shown any signs of ability to work out the great problem of civilisation for themselves as a race, or indeed to improve by the example and under the tuition of the European. The apologists of the negro, who would place him on the same level as the white man in every respect, urge that their statement is true, because Fabre Geffard, the ex-president of Hayti, and a few others, have evinced considerable administrative ability, and because Africa has produced one negro bishop of great learning, and exemplary worth and piety—the Rev. Samuel Crowther, Bishop of Sierra Leone. But here, as in other cases, the exception goes only to prove the rule, and the great fact remains the same, that the Africa of to-day is much the same as the Africa of a thousand years ago—a vast country teeming with natural wealth, which the inhabitants are unable to turn to good account, and cut up into districts held by petty tribes, whose chief purpose and pleasure of life seems to be to injure, plunder, kill, or kidnap one another for sale to traders as slaves, whenever a fitting opportunity offers. Hence it is impossible to give the student, as in the case of other continents, a clearer or more trustworthy summary of the divisions of Africa than the following—divisions which are for most part arbitrary, and separated from each other by no natural landmarks, or political boundaries laid down and defined by man. It must be remembered, as in the summary of the chief divisions of Asia, that the figures relative to areas, population, etc., are only approximately stated, while the cities whose names are printed in italics are only the most important or most populous towns in the divisions after which they stand.

THE CHIEF DIVISIONS OF AFRICA—THEIR CAPITALS, AREA, POPULATION, ETC.

Divisions or States.	Capitals.	Rivers, etc., on which the Capitals, etc., stand.	Approximate Area in Square Miles.	Approximate No. of Population.	No. of Inhabitants to every Square Mile.
MAROCCO	Marocco	Tensift . . .	314,000	6,000,000	19
ALGERIA	Algiers . . .	Sea coast . .	258,300	2,450,000	9½
TUNIS	Tunis	Sea coast . .	44,490	2,100,000	46
TRIPOLI, WITH BARCA AND PEZZAN . .	Tripoli . . .	Sea coast . .	399,000	1,010,000	2½
EGYPT	Cairo	Nile	494,000	6,806,000	14
NUBIA, WITH KORDOFAN	Khartoom . .	Nile	400,000	2,000,000	5
ABYSSINIA	Gondar . . .	nr. L. Dembea .	120,000	3,000,000	23
SAHARA			2,500,000	1,000,000	¾
SENEGAMBIA	Bathurst . .	Gambia . . .	250,000	10,000,000	40
SOUDAN, OR NIGRITIA	Sackatoo . .	Zirnie	2,250,000	10,000,000	17½
LIBERIA	Monrovia . .	St. Paul . . .	14,000	1,050,000	75
UPPER GUINEA	Abbeokuta . .	nr. Sea coast .	300,000	7,000,000	23
LOWER GUINEA	San Salvador .	near Congo . .	250,000	3,000,000	12
REGIONS IN INTERIOR			3,000,000	30,000,000	10
EASTERN AFRICA	Shanganey . .	Zanzibar I. . .	1,000,000	10,000,000	10
HOTTENTOT LAND, ETC. . . .			250,000	1,000,000	4
TRANSVAAL	Potchefstroom .	Vaal	110,000	800,000	7
ORANGE RIVER FREE STATES	Bloemfontein .	nr. Orange R. .	41,500	133,500	3
NATAL	Pietermaritzburg .	nr. Sea coast .	18,750	424,500	22
CAPE COLONY AND BRITISH KAFFRARIA	Cape Town . .	nr. Sea coast .	240,000	1,250,000	5
MADAGASCAR	Tananarivo . .	Inland	228,500	3,000,000	13

Marocco, an empire in the north-western corner of Africa, is one of the Barbary States, the others being Algiers, Tunis, and Tripoli. It is divided into four provinces, Fez, Marocco, Sus, and Taflet. The chief sea-ports are Tangier and Mogador. Among the manufactures of Marocco, the leather which takes its name from the country deserves especial mention, being remarkable for its extreme softness and pliancy, and its peculiar brilliancy of colour. The Barbary States, and the oases or fertile islands in the sandy sea of the Sahara, are famous for dates, which form the principal vegetable food of the wandering tribes. Algeria, lying on the sea-board of the Mediterranean, to the east of Marocco, is a large and important French colony, taken

by the French from the Dey of Algiers in 1830, but not wholly subdued until 1847, when Abd-el-Kader ceased to offer resistance to the French troops. It is divided into three provinces—Algiers, Oran, and Constantine. The French settlers are chiefly engaged in the production of cotton and wine, nearly 100,000 acres having been planted with choice vines from the best wine-growing districts of France and Spain. The other possessions of France in Africa, or in African waters, of importance, are St. Louis and Goree in French Senegambia, and Réunion or the Isle of Bourbon, eastward of Madagascar.

Tripoli and Barca, lying eastward of Algeria along the coast of the Mediterranean Sea, and Fezzan, a large oasis to the south of Tripoli, form a dependency of the Ottoman Empire, under an officer styled the Pasha of Tripoli, who acts as governor-general, appointing lieutenant-governors, or beys, in other provinces under his control. Tunis formerly stood in a similar relation to the Ottoman Empire, but it is now an informally annexed dependency of France, although nominally governed by a bey.

Egypt, bounded on the north by the Mediterranean, and having its eastern coast washed by the Red Sea, is divided into three parts—Lower Egypt in the north, which includes the delta of the Nile; Middle Egypt in the centre; and Upper Egypt in the south. Nominally it is a dependency of the Ottoman Empire, but Egypt is also an independent country, the government being hereditary and vested in the family of Mehemet Ali, who rendered himself master of the country by the slaughter of the Mamelukes in 1811. Egypt is, however, dependent for its existence as a Sovereign State upon the will of stronger powers. On the breaking out of a revolt, headed by Arabi Pasha, England intervened to re-establish the authority of the Khedive, and English influence still predominates in Egypt. Among the noteworthy engineering works of the present day, the canal cut across the Isthmus of Suez, to enable ships to pass from the Mediterranean Sea to the Red Sea, occupies a conspicuous place.

Nubia and Kordofan, situated between Egypt and Abyssinia, have been, since 1821, subject to Egypt. The people of Southern Nubia are a powerful and athletic race of negroes.

Abyssinia is a large country in the east of Africa, divided into several petty states, the chief of which are the kingdom of Gondar (or Amhara), the kingdom of Shoa, and the kingdom of Tigre, of which the chief towns are respectively Gondar, Ankobar, and Antalo. The most powerful of the native princes assumes the sovereignty of the whole of Abyssinia, under the title of "negus," holding the same position among the other princes as the Saxon "bretwalda" held among the princes of the Saxon heptarchy. The religion of the Abyssinians is a debased form of Christianity.

The great desert called Sahara stretches westward across the continent, from the western confines of Nubia to the Atlantic. It is a vast table-land, consisting of a sandy surface studded here and there with rocky tracts, and with nothing to break the dreary monotony of its appearance except a few islets of verdure called oases, formed in depressions of the desert, and watered by springs that are never known to fail. Its inhabitants are wandering tribes of Berber origin.

Senegambia is a comparatively small district on the west coast of Africa, extending from St. Louis in the north, to the confines of Liberia in the south. The interior is peopled with native tribes. On the coast are the British settlements of British Senegambia (chief town, Bathurst) and Sierra Leone (chief town, Freetown); the French settlements of St. Louis and Goree, already mentioned, in French Senegambia; and Bissao, in Portuguese Senegambia. The independent state of Liberia, to the south of Senegambia, is peopled in some measure by blacks redeemed from slavery, having been established, in 1848, as a safe retreat for negroes rescued from slavers, and for free blacks from the United States of America. Liberia may be considered as forming a part of Upper Guinea.

Soudan or Nigritia, the country in which the true negro is found, lies to the south of the Sahara, between the desert on one side, and Upper Guinea and the unexplored regions of Central Africa on the other. It consists of a great number of petty states, the principal of which are Bambarra (chief town, Sego), Timbuctoo (chief town, Timbuctoo), Borgou (chief town, Boussa), Sackatoo (chief towns, Sackatoo and Kano), Mandara (chief town, Delow), Bornou (chief town, Kouka), and Begharmi, or Bagirmi (chief town, Masena). The people of Soudan are the farthest



advanced in civilisation of the aborigines of Africa, possessing a knowledge of agriculture and the method of irrigation of land from rivers and lakes, and manufacturing cotton cloth and iron implements of various kinds.

Upper Guinea extends from the northern confines of Liberia to the mouth of the Calabar river; Lower Guinea from the mouth of the Calabar river to the mouth of the river Nource. The coast of the Gulf of Guinea, from Liberia to the Bight of Benin, is divided into portions called the Grain Coast, Ivory Coast, Gold Coast, and Slave Coast. The chief native states are those of Ashantee (chief town, Coomassie), Dahomey (chief town, Abomey), Yarra (chief town, Abbeokuta), Benin (chief town, Benin), Eggarah (chief town, Iddah), and Old Calabar (chief town, Bongo). The principal British possessions on this part of the African coast are the Gold Coast Colony, the chief settlement in which is Cape Coast Castle, and Lagos, an island not far from the embouchure of the Niger. Elmina is the capital of the Dutch possessions on the coast of Upper Guinea. The negroes of Ashantee and Dahomey are a cruel and ferocious race, frequently sacrificing the prisoners they take in war.

A great part of Lower Guinea is claimed by the Portuguese, who possess some settlements on the coast, St. Paul de Loanda, the capital of Angola, being the chief of them. The remaining provinces of importance are Biafra (chief town, Biafra), Loango (chief town, Loango), Congo (chief town, San Salvador), and Benguela (chief town, San Felipe de Benguela).

Eastern Africa, stretching from the Arabian Gulf to the northern confines of Natal, may be divided into two districts, north and south of the equator. The former comprehends the country of the Gallas on the southern frontiers of Abyssinia, with Ajan, and the country of the Somaulis, in the tongue-shaped peninsula terminating in Cape Guardafui. The chief towns in these districts are Zeyla and Berbera, on the Arabian Gulf, and Harar in the interior. Zanguebar, comprising the provinces of Magadoxo (north of the equator), Jubba, Melinda, Zanzibar, and Quiloa, is under the control of a Sultan, whose capital is Shauganny, a town on the island of Zanzibar. Mozambique and Sofala nominally belong to the Portuguese. Between Sofala and Natal lies a district called Amazula, or Kaffraria. To the west of Amazula lies the Transvaal, settled by Dutch boers, or farmers, annexed to the Cape Colony in 1877, but in 1881 re-ceded to the boers.

To the west of the Transvaal territory, between it and the Atlantic sea-board north of the Orange River, lies the country of the Hottentots and Bushmen, a race apparently but little removed above the brute creation, so ignorant are they of the rudest arts and filthy in their habits. They offer a marked contrast to the fierce and warlike Kaffirs, who have given considerable trouble at various periods to the government and inhabitants of Cape Colony.

South of the Orange River lie the British dependencies called Cape Colony and Natal, and the district known as the Orange River Free States, a republic of Dutch boers, who retired thither from Natal when it was made a British colony, in 1843, in connection with Cape Colony. Great Britain resigned all jurisdiction over the Orange River Free States in 1854. Natal was erected into a colony distinct and separate from the Cape in 1856. A continuation of Kaffraria lies between Natal and Cape Colony.

In 1866, British Kaffraria, on the east of Cape Colony, was incorporated with it. The colony of the Cape of Good Hope is divided into the eastern and western provinces, which are subdivided as follows:—

WESTERN PROVINCE.			
District.	Chief Town.	District.	Chief Town.
Clanwilliam . . .	Clanwilliam.	Cape	Capetown.
Beaufort	Beaufort.	Stellenbosch . . .	Stellenbosch.
Malmesbury . . .	Malmesbury.	Caledon	Caledon.
Tulbagh	Tulbagh.	Swellendam . . .	Swellendam.
Worcester	Worcester.	George	Georgetown.
Paarl	Paarl.		

EASTERN PROVINCE.			
District.	Chief Town.	District.	Chief Town.
Uitenhage	Uitenhage.	Beaufort	Beaufort.
Graaf Reynet . . .	Graaf Reynet.	Albany	Grahamstown.
Colesberg	Colesberg.	Victoria	D'Urban (?).
Albert	Burgers-	Queenstown . . .	Queenstown.
	dorp (?).	British Kaffraria .	Williamstown.
Craddock	Craddock.	Basuto Land . . .	Smithfield (?).
Somerset	Somerset.		

Gold was discovered to the north of the Limpopo river in 1868, in a district bordering on the Transvaal Republic. Copper, lead, cobalt, silver, iron, coal, and tin are also found in the Transvaal. Its chief riches, however, consist in cattle and various agricultural produce, wheat, for example, growing very luxuriantly in the watered districts, and peaches, grapes, and oranges also flourishing.

READINGS IN GERMAN.—XI.

14. Byron und Polidori.

Wie Lord Byron selbst erzählt, fand folgendes Gespräch zwischen ihm und Polidori, einem sehr eiteln, italienischen Arzte während einer Rheinreise statt. „Was können Sie denn thun, wozu ich nicht im Stande wäre?“ fragte der Arzt. „Da Sie mich drängen,“ antwortete der Dichter, „so will ich es Ihnen sagen; ich glaube, es giebt drei solche Dinge.“ Polidori bestand darauf, daß er sie nennen sollte, und Lord Byron sprach: „Ich kann über tiefen Strom schwimmen; ich kann ein Licht auf eine Entfernung von zwanzig Schritten mit einem Pistolenkugeln ausblasen; und ich habe ein Gedicht geschrieben, von dem an einem Tage 14,000 Exemplare verkauft worden sind.“

VOCABULARY AND NOTES.

- (1) Eitel, *adj.* vain, frivolous. (4) Drängen, to urge.
(2) Rheinreise, *f.* a journey on the Rhine. (5) Ausblasen, to snuff out.
(3) Im Stande sein, to be able. (6) Exemplar, *n.* copy.

15. Heinrich der Achte und Thomas More.

Heinrich der Achte von England und Franz der Erste von Frankreich waren beide Fürsten von sehr heutigem Temperament. Nun wünschte Ersterer eine ärgerliche Beisatz an Letzteren zu senden, und wählte seinen Kanzler Thomas More dazu aus. Nachdem More seine Weisung empfangen hatte, sprach er: „Sire, wenn ich diese Beisatz einem so heftigen Manne, wie dem Könige von Frankreich überbringe, so wird es mir den Kopf kosten.“ „Sein Sie unbesorgt,“ antwortete der König, „wenn Franz Ihnen den Kopf abhauen läßt, so werde ich jenen Franzosen, der jetzt in meiner Macht ist, einen Kopf fürger machen lassen.“ „Ich bin Ew. Majestät sehr verbunden,“ versetzte der Kanzler; „aber ich bezweifle sehr, daß irgend einer von diesen Köpfen auf meine Schultern passen wird.“

VOCABULARY AND NOTES.

- (1) Temperament, *n.* temper, disposition. (5) Unbesorgt sein, to have no care.
(2) Beisatz, *f.* message. (6) Einen Kopf fürger machen, to make shorter by a head, to decapitate.
(3) Letztern, the latter. (7) Passen, to fit.
(4) Weisung, *f.* directions. (8) Heftig, *adj.* violent.

16. Der Binger Mäufethurm.

Von den Brüdern Grimm.

Bei Bingen¹ ragt mitten aus dem Rhein ein hoher Thurm, von dem nachstehende Sage umgeht.² Im Jahre 970 ward große Theuerung³ in Deutschland, daß die Menschen aus Noth⁴ Hagen und Hunde aßen und doch viele Leute Hungers starben.⁵ Da war ein Bischof zu Mainz, der hieß Gatto der Andere,⁷ ein Weisheit⁸ dachte nur daran, seinen Schatz zu mehren, und sah zu, wie die armen Leute auf der Gasse nietersielen, und bei Haufen zu den Brotschnecken¹¹ liefen und das Brot mit Gewalt nahmen. Aber sein Erbarmen¹² kam in den Bischof, sondern er sprach: „Räufte alle Arme und Dürftige sammeln¹³ in einer Scheune¹⁴ vor der Stadt, ich will sie speisen.“ Und wie sie in die Scheune gegangen waren, schloß¹⁵ er die Thür zu, steckte die Scheune mit Feuer an¹⁶ und verbrannte sie sammt¹⁷ den armen Leuten. Als nun die Menschen unter den Flammen wimmerten¹⁸ und jammerten, rief Bischof Gatto: „Hört, hört, wie die Mäuse pfeifen!“ Allein Gott, der Herr, plagte ihn bald, daß die Mäuse Tag und Nacht über ihn liefen und an ihm fraßen und er sich mit aller seiner Gewalt nicht wider sie zu wehren vermochte.¹⁹ Da wußte er endlich seinen andern Rath, als daß er einen Thurm bei Bingen mitten in den Rhein bauen ließ, der noch heutiges Tages zu sehen ist; darin meinte er sich zu verstecken, aber die Mäuse schwammen durch den Strom heran, erklommen den Thurm und fraßen den Bischof lebendig auf.

VOCABULARY AND NOTES.

- (1) Bingen, a small town on the Rhine. (4) Theuerung, *f.* dearth.
(2) Umgeht, is current. (5) Aus Noth, from necessity.
(3) Ragt, stands out. (6) Hungers starben, died of hunger.

- (1) Der Andere, the second.
(2) Weisheit, *n.* wisdom, grasping mad.
(3) Sah zu, looked on.
(4) Bei Haufen, in crowds.
(5) Brotschnecken, bread-shops.
(6) Erbarmen, compassion.
(7) Sammeln, be collected.
(8) Scheune, *f.* barn.
(9) Schloß er die Thür zu, he shut

- the door; pres. ich schloße zu; imperf. ich schloß zu; past. zugeschloß.
(10) Anfeuern, set fire to.
(11) Sammt, together with.
(12) Wimmerten, were whining.
(13) Vermochte, imperf. of vermögen, to be able.
(14) Sich zu verstecken, to have a respite.

17. Joseph II., Kaiser von Oesterreich.

Joseph II., Kaiser von Oesterreich, wollte einem alten Offizier zur Unterhaltung¹ und Pflege² von dessen kranker Frau seine letzten 24 Gelbstüde³ geben. „Darauf zu viel,“ unterbrach ein Höfling,⁴ „24 Gulden sind genug.“ „Haben Sie diese?“—Der Dienstfertige⁵ zieht solche emsig aus der Börse; Joseph nimmt sie, fügt seine 24 Gelbstüde hinzu, und giebt sie dem Offizier zusammen mit den Worten: „Veranthen Sie sich bei dem Herrn, der sehr vergnügt darüber ist, auch etwas zur Unterung⁶ Ihrer Noth beigetragen zu haben.“

VOCABULARY AND NOTES.

- (1) Unterhaltung, *f.* sustenance. (4) Höfling, *m.* courtier.
(2) Pflege, *f.* nursing, care. (5) Dienstfertige, officious, (literally) ready to serve.
(3) Unterbrach, the imperfect of the verb unterbrechen, to interrupt. (6) Unterung, *f.* lessening, relief.
(7) Beitragen, to contribute.

18. Friedrich der Große und sein Arzt.

Zimmermann, ein ausgezeichneter Arzt¹ kam von Hannover, um Friedrich den Großen in seiner letzten Krankheit zu behandeln.² Eines Tages sagte der König zu ihm: „Sie haben, wie ich vermüthe,³ Manchem in die andere Welt geholfen.“ Dies war eine grobe Reteweise⁴ und eine unangenehme Pille für den Doctor; aber die Devis, welche er dem Könige weiter gab, war ein schärffinniges⁵ Gemisch von Wahrheit und Schmeichelei:⁶ „Nicht so vielen, als Ew. Majestät, und auch nicht mit so viel Ehre.“

VOCABULARY AND NOTES.

- (1) Distinguished physician. (5) Grobe Reteweise, rude speech.
(2) Behandelte, to treat. (6) Schärffinnig, clever.
(3) Wie ich vermüthe, as I guess. (7) Schmeichelei, *f.* flattery.
(4) Geholfen, *p. p.* of helfen, to help.

19. Carl der Zweite und sein Bischof.

Carl der Zweite fragte den Bischof Stillingfleet, wie es zuginge,¹ daß er gewöhnlich ohne Buch predigte,² aber bei Hofe seine Predigten immer ablas.³ Der Bischof antwortete: „Die Ehrfurcht⁴ vor einem so großen und weisen Fürsten macht, daß ich mich nicht traue. Aber wollen Ew. Majestät mir zugehen⁵ auch eine Frage erlauben? Warum lesen Sie Ihre Reden im Parlamente?“ „Warum?“ erwiderte der König, „das will ich Sie aufrichtig⁶ sagen. Ich habe Sie so oft um Geld gebeten,⁷ daß ich mich schäme, Ihnen ins Gesicht zu sehen.“

VOCABULARY AND NOTES.

- (1) Zuginge, happened; subj. imperf. of zugehen; pres. ich gehe zu; imperf. ich ging zu; past. zugegangen.
(2) Predigte, preached (from Lat. predicare).
(3) Ablas, read.
(4) Ehrfurcht, *f.* reverence.
(5) Zugehen, in return.
(6) Aufrichtig, plainly, openly.
(7) Um Geld gebeten, begged money.
(8) Ihnen ins Gesicht zu sehen, to look them into the face.

COMPARATIVE ANATOMY.—XV.

DIVALE MOLLUSCS: BRACHIOPODA (= PALLIOBRANCHIATA) AND CONCHIFERA (= LAMELLIBRANCHIATA).

THERE are two classes of soft-bodied animals which secrete a hard, chalky substance in the form of two hollow saucer-shaped pieces, that fit more or less closely together along their edges, and which, therefore, when drawn together, can completely protect the animal, that lies wholly between them, from all injury. These are called *Bivalve Molluscs*. The shells are usually so united at one point in their circumferences as to play upon that point as a hinge, while the remainder of the two shells can be separated so as to gape more or less widely on the side opposite the hinge. In this manner the creatures can keep open house when their guests are likely to be those upon which they

can prey, and can shut their folding doors when they are themselves likely to be victimised. These shells are usually thick and heavy, especially in those species which are marine, for the wear and tear of the sea is greater, and the predatory creatures more powerful than those in fresh water. Moreover, the box or house must be tolerably capacious, otherwise the creatures could not breathe while they were in a state of siege, and must surrender at discretion to the expectant lobster or other froc-booter of the deep. It follows that this arrangement is not well suited to locomotion; and not being locomotive to any great degree, they are not endowed with those perfect organs of sense that must be possessed by those animals which chase their prey. When organs of sense are possessed, they are usually collected on a protruded part of the body, and placed above the mouth, which opens at the front part. Such a projection, which supports the eyes, feelers, ears, and smelling capsules, and contains a nervous centre conveniently and closely situated to these gateways of knowledge, is usually called a head. Now these bivalve molluscs are distinguished from the higher orders in having no heads, and are called *acephalous*. They have mouths, and a nerve-knot above this; but the mouth is not prominent, and lies far within the shelly box, and often between soft projections of the body, which extend some distance beyond it. Their organs of sense are also very poor and imperfect; and when they are possessed at all, they are placed in other parts of the body. The two classes which together compose the group of headless, two-shelled Mollusca are extremely different in structure throughout. There is, however, an external difference by which they may be distinguished by a superficial observation. In the Brachiopods the shells are secreted on extensions of the membrane of the body on the back and front of the animals; while in the Conchifera the shells are placed upon membranes which are developed from the sides of the animal. Thus, if both animals were split down the middle by a cutting instrument, which should leave the divided halves more or less alike, that instrument would pass through both shells of the Brachiopods, dividing them both into two equal parts, while it would not cut the shells of the Conchifer at all, but only sever them the one from the other. This arrangement of the animal to the shell is contrasted in the illustration, in which it will be seen that the separate shells of the Brachiopod are bisected into two absolutely similar halves by a line running down the middle. On the other hand, a line dividing the Brachiopod so as to sever the shells leaves two portions, which are unlike, both in size and form. A similar line, separating the conchiferous shell, leaves two equal and similar parts. It should, however, be remarked that the ordinary position occupied by both classes of bivalves, resting as they do on the bottom of the sea, sometimes interferes with the bilateral symmetry of the Conchifers, while it leaves that of the Brachiopods untouched. In the Brachiopods the double shell is flattened as if the back and front of the animal had been squeezed together, and this kind of flattening is technically called *depression*. In Conchifera the double shell is usually flattened as though the creatures had been squeezed by pressure applied to its sides, and this flattening is called, in the language of Comparative Anatomy, *compression*. Now, as these passive creatures, whether fixed or free, usually rest on the floor of the sea, it follows that they must lie, not on the edges, but on the flats of their shells; and when thus lying, they rest habitually on one shell, and this shell is often so modified in relation to the other as to suit the lying posture. The Brachiopods rest on their ventral shell, with the back or dorsal shell uppermost, and therefore this modification does not interfere with the symmetry or equality of their two halves; but it does interfere with the symmetry of the Conchifera, because they rest on their sides. A similar instance of this effect of habit on the two-sided arrangement of the body is seen in the soles, turbot, etc., which constitute the family of fishes called *Pleuronectidae*, as contrasted with the equally flat rays. The depressed rays, lying with their backs uppermost, are quite symmetrical; while the soles, resting on their sides, are quite distorted in shape, and the two sides differ in colour. Notwithstanding this tendency to one-sidedness in the Conchifera due to habit, most of them have nearly equal valves; and in none is the internal arrangement of organs much interfered with. Having thus drawn attention to the superficial contrast between the classes, we proceed to describe the Brachiopoda,

which are far inferior to the Conchifera, and bear a stronger relation to the Tunicata and Polyzoa than they do to the other class, which will come under our notice in the after-part of the lesson.

Brachiopoda.—These creatures are, for the most part, fixed to the rocky bottom of the sea, either by a fleshy stalk, which passes out from the body through a hole, a slit, or a passage in the ventral valve, or else by having this under-valve fixed to its support directly. In the first case the connection is organic, and the creature can move itself upon its stalk by the aid of muscles, which are placed inside the shelly box; and in the latter case the connection is inorganic, and the creature is entirely immovable. Taking the *Waldheimia* as a type, because it is the genus which has been best studied, not only by Continental anatomists, but also by Hancock, Huxley, and Owen, we proceed to describe its structure. The reader should, however, be warned that though this is a good typical Brachiopod, all that will be said about it does not apply to every species of the class, and that the structure has been very differently interpreted and explained by the great naturalists above named.

The shells are best understood from the illustration. It will be observed that the ventral shell is very concave and globose, lodging the animal as in a cup, while the dorsal shell is nearly flat, and acts as a lid to the cup. The ventral shell has a round hole in one end through which the stalk passes. Between this hole and the great opening of the shell is a triangular space, and at the angles at the base of the triangle are two little teeth. These teeth fit into sockets in the flat shell, which has also developed from it a large calcareous loop. This loop consists of two arms, which run forward on either side, and then, leaving the shell, are turned back to unite almost above (or below, in the natural position of the animal) the point from which they spring. When the two shells are placed together as when the animal occupies them, they look not unlike the Eastern oil-lamps which are always represented as being carried by the ten virgins in pictures of the parable; the hole in the ventral shell, of course, corresponding to that through which the wick passes in the lamp. Hence, these shells have been called lamp-shells. When the valves are united on the hinge as in life, this hinge does not allow them to be parted from one another, except for a short distance. The soft parts of the animal occupy a very small part of its hard box, being confined almost exclusively to the part between the arms of the loop, and to about the one-third of this space nearest the hinge. This restriction applies to the visceral and muscular masses. There are, however, large

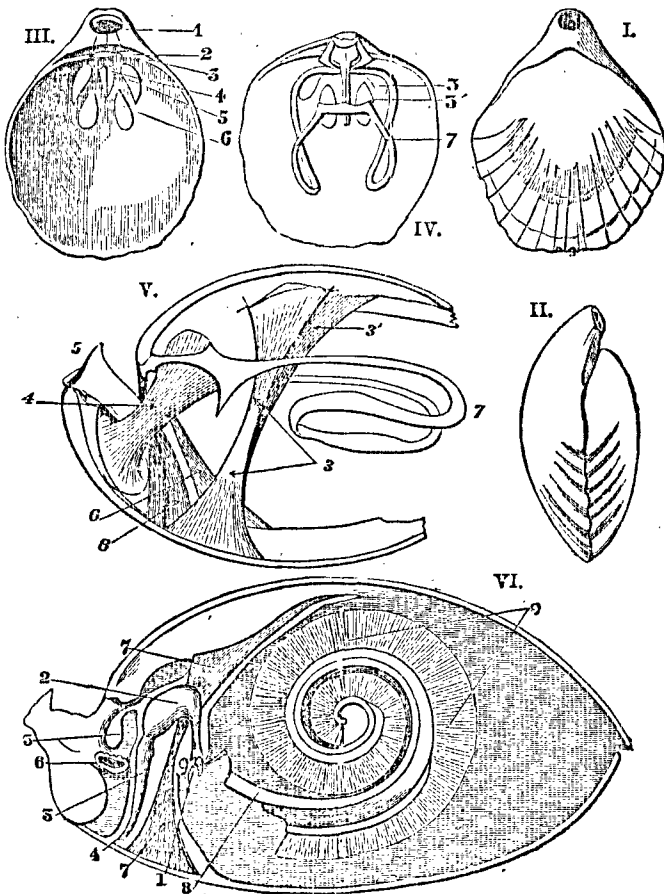
and long extensions of the body stretching beyond this confined space. Thus, two large vascular membranous sheets line the valves right up to the very edge of the shell, where they are fringed with strong and numerous bristles. There are also two long arms, which stretch away from the mouth on each side. These are so long that, if unfolded, they would stretch beyond the limits of the shell; but they are supported by the calcareous loop, and follow its bendings. These arms have a delicate fringe of little fingers, which arise all along their outer sides; and

these little fingers are clothed with cilia, which create currents of water towards the mouth, and thus the animal is fed. The mouth has no hard parts or jaws, but only two lips, of which the arms may be considered the sidelong extensions. It opens towards the gaping part of the shells, and also downward. The stomach is rounded, and receives the passages from the liver which surrounds it, and the intestine bends downward and ends blindly below. At the back and above the stomach is the simple sacular heart, which sends off from each of its sides two vessels, one of which goes to the stomach and viscera, and the other to the mantle lobes. These lobes of the mantle are so well supplied with blood, and the vessels are so large which traverse them, that it is supposed that the blood is there aerated, and hence these creatures have been called *Palliobranchiata*, or breathers by means of the mantle. Round the edge of each lobe of the mantle which lines the valves is a circular channel, and this first receives the blood from the heart, and from there it passes back through the more central parts of the lobes, being first conveyed through fine vessels, and then collected into larger and larger vessels until it is returned by large sinuses to the central parts. When the blood has arrived at these central parts, some of it goes to supply them directly, whilst the residue runs along the vessels of the arms and the membranes

connecting the arms, and so returns from them after having passed through the fine fringes. Thus it is probable that these ciliated fringes of the arms are efficient, and perhaps the most efficient, instruments of aëration of the blood. After the return from the arms and viscera, the blood on both sides of the body is collected into a vessel which runs along above the stomach, and then enters the heart again.

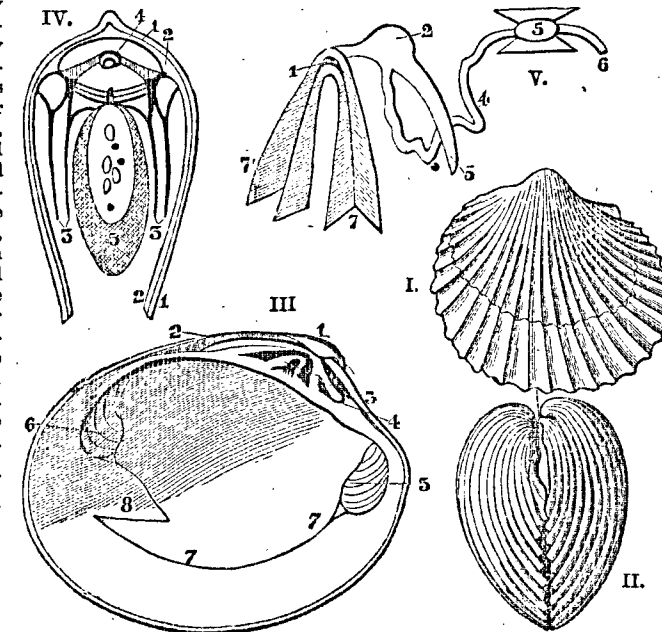
Two organs, each with two compartments, and situated one on each side of the body, have sometimes been considered as hearts; but they seem more probably to belong to the water-vascular system, as they open externally to the animal, and convey away the generative products.

The nervous system of the animal is very simple; the central



BRACHIOPODA.—I. WALDHEIMIA. II. DITTO, SIDE VIEW. III. DITTO, VENTRAL VALVE. IV. DITTO, DORSAL VALVE. V. DITTO, SHOWING THE MUSCULAR SYSTEM. VI. DITTO, TO SHOW ARRANGEMENT OF VISCERA.
Refs. to Nos. in Figs.—III. 1, aperture through which pedicel is passed; 2, impression of capsular muscle; 3, teeth of the hinge; 4, impression of the adductor muscles; 5, impression of pedicel muscles; 6, impression of cardinal (adductor) muscles. IV. 3, posterior adductor and (3') anterior adductor impressions; 7, carbonate of lime loop to support the arms. V. 3, 3', adductors; 4, pedicel muscles; 5, pedicel; 6, cardinal and (8) ventral pedicel muscles; 7, loop. VI. 1, mouth; 2, stomach; 3, intestine; 4, anus; 5, heart; 6, entrance to pulsatile vessel; 7, adductor muscle; 8, loop; 9, arm-fringes.

ganglion being situated above and in front of the stomach. The system of muscles to which it sends nerves is very complicated. This is the only system in which the Brachiopods seem to have a more complicated structure than the Conchifera. A pair of muscles called adductors run from the ventral to the dorsal shell. They are attached to depressions, which are close together in the ventral shell; and at their other ends to other depressions, which are wider apart in the dorsal shell. These in contraction, of course, close the valves. Arising from the outside and front of these are two paired muscles, which are inserted in the dorsal valve behind the hinge-joint, and which thus open the shell when contracted. Other muscles go from the ventral and dorsal valves to the stalk, and these, as well as the pair last named, have smaller muscles to assist their action. The position of these muscles, and of the pits in the shell to which they are attached, vary in the different species of the class, and form good



CONCHIFERA.—I. CARDIUM. II. DITTO, SIDE VIEW. III. CYTHEREA. IV. DIAGRAMMATIC TRANSVERSE SECTION OF A CONCHIFER (LAMELLIBRANCH). V. ISOLATED ALIMENTARY CANAL OF A SOLE.
Refs. to Nos. in Figs.—III. 1, umbo or elbow; 2, external ligament; 3, cardinal teeth of the hinge; 4, lateral ditto; 5, anterior adductor; 6, posterior ditto; 7, mantle lining; 8, the sinus. IV. 1, shell; 2, mantle; 3, gills; 4, heart traversed by the intestine; 5, foot inclosing folds of the intestine and vessels. V. 1, mouth; 2, stomach; 3, blind sac containing the endostyle; 4, intestine; 5, heart; 6, anus; 7, 7, membranous lips.

The relation of these breathing plates is best seen in the illustration, where there is a section given of the animal as it would appear if it were cut across so as to divide both shells. These gill-plates secure that the blood shall be well aerated, not only by exposing as large an amount of surface as possible, but also by having gill-tubes, which run through the plates from one edge to the other, through which the water passes. As is usually the case with breathing surfaces in marine animals, the plates are covered with cilia, whose motion secures a constant change in the water. The gill-plates are very variously modified in the different families of *Lamellibranchiata*; but they are constant throughout the class.

In some, as the oyster, the mantle simply lines the shells and ends at their edges, so that the water has free entrance from all sides. In other families the mantle of one side passes across the aperture of the shell to be united at certain points, or along almost its whole length, to the mantle of the opposite shell. In others the animal is not only almost entirely walled in by the union of the two lobes of the mantle, but part of this mantle

is drawn out into two long tubes, one of which communicates with the chamber in which the gills lie, and the other with the smaller lined chamber into which the anus opens, and into which, also, the gill-tubes discharge the water. This last arrangement is carried to an extreme in those species which burrow and live in holes of the rock or mud of the sea-bottom. The only communication which these have with the outer world is by means of their extended tubes or *siphons*, as they are called. In their case the two tubes are united into one sheath, although a partition passing down the double tube always keeps them functionally distinct. In these creatures the action of the cilia drives the water in one continuous stream from the gill chamber to the atrial chamber through the tubes; and this motion necessitates a flow down one tube and up another. By this means floating food is passed along the gills to the mouth, which is situated at the lower end of the buried molluscs, and

thus we have a similar mode of life to that of the tunicates, though the breathing apparatus is of a different structure.

The mantle being thus relieved from the duty of exposing the blood to the oxygen dissolved in the water, is wholly employed in its proper function of secreting the shell. It performs this office in a very efficient manner, so as always to allow for the growth of the animal and for the strengthening of the shell as the contained animal becomes more weighty, and therefore liable to experience more violent collisions. The method of secretion is the following:—Round the edge of the mantle lobes, or at that part where they leave the shells, are situated a great number of glands, whence secretions of different substances are poured out and mingled together. These glands secrete horny matter, a large quantity of carbonate of lime, and some pigment. Thus a fresh rim of hard matter is added at intervals to the shell. The size, shape, markings, and colours of the shell are all determined by the edges of this mantle; and the whole of these characters

differ so greatly in the different species, and the result is so beautiful in many, that a collection of shells is very interesting. The nucleus, or starting-point from which the formation of the shell proceeds, is called the umbo; and the manner in which the additions are made is very various. Sometimes the mantle edge secretes a great deal of matter at one time of the year, and is nearly inactive, or only pours out a thin secretion, at another; and this will produce a shell with ridges and furrows parallel to the edges of the shell, which are called *sulca*. If the mantle secretes at certain points, in larger quantity, and but little between these points, or if it be folded or puckered, and the folds remain so during the whole of the growth, then ridges and channels are formed, stretching continuously from umbo to margin. If the margin of the mantle is much folded and thrust out during secretion, it sometimes results in long points or projections, which reach far beyond the rest of the outside of the shell. In the same way it will be seen that the lining and colouring of the shell into patterns may be effected by the partial and intermittent secretion of colouring matter. The shell, while it is being

should lead to entitle them to the actual sovereignty of the Messiah.

When a king was first given to Israel, it was clearly understood that he should be under the tutelage of prophets, who should communicate to him the will of the King of kings, in whose name and in whose stead he wore the crown. This tutelage was exercised by the prophets in a way that was not likely to be acceptable to princes, especially to princes who preferred to reign in their own names to the name of the ultimate King of Israel; and we find early instances of dire conflict between the spiritual and temporal powers—conflicts which went to the extent of deposition on the one side, and of sanguinary persecution on the other.

For a time, however, Saul was king, in spite of the murmurs of those who objected to the elevation of an equal; and in his successful wars with the Philistines and the Amalekites justified the choice which had appointed him king. His valour and personal prowess, seconded by the gallant efforts of his sons, especially of Jonathan, won for him a renown which no amount of subsequent misfortune could extinguish. Even in the wrong he did by not obeying the express commands of the prophet who had anointed him king, he was credited with an amount of generosity that went far in the people's sight to excuse him, while as a leader and prince he enlisted their entire sympathies. The disobedience of which Saul was guilty in the matter of Agag was but one of many instances in which, while he showed himself a man of whom an army of Philistines might have been proud, he showed incontestably that he was not fit for the post of vice-regent for Jehovah. For these acts of unfaithfulness Saul was deposed, though he was allowed to die the death of a warrior instead of falling into the hands of his enemies, and the kingdom was given to another. Judged by any other than the highest standard, Saul would have been considered guilty of at least venial offences in what he had done, and there was a certain something about him which, in spite of his brutality, made him admired of his subjects—a soldierly feeling which has been portrayed in the well-known Hebrew melodies of Lord Byron—

"Warriors and chiefs, should the shaft or the sword
Pierce me while leading the hosts of the Lord;
Heed not the corse, though a king's, in your path;
Bury your steel in the bosoms of Gath."

The kingship which was taken from Saul was conferred upon David, of the tribe of Judah, in spite of an opposition manifested by the northern tribes in favour of Ishbosheth, a younger son of Saul. The splendour of David's reign, his success in war, and the faithfulness with which he accomplished his mission to destroy the heathen who hemmed in the chosen people, and set them examples which they were too prone to follow, are matters well known to all who are familiar with the Bible narrative. During the reigns of David and of Solomon, the feeling of dissension between the northern and southern tribes which had shown itself at Saul's election, and again at his death, did not express itself in any national way. The rebellions against David were encouraged and fed by it, and the fact of its existence was vouched for in several independent ways, but not nationally. On the death of Solomon, however, this dissension took an active form. The expenses of Solomon's government had pressed sore on the people, who complained that the wealth of the nation was centered in one city, that the general welfare was neglected for the sake of Jerusalem, and that the king cared little what happened to other borders of his kingdom so long as the borders of Judah and Benjamin were respected. This feeling was so far from being wisely dealt with by Rehoboam, Solomon's son and successor, that he openly declared his intention of governing yet more severely than his father had done, of chastising with scorpions instead of whips, and of holding himself accountable to no one, but to his own will only. In vain did Jeroboam, as representative of the northern tribes, request redress of grievances; the king refused to believe in the extent of the disaffection towards him, and dismissed the remonstrants at the same time that he sent out collectors to gather in his taxes. The tax-gatherer in this as in other cases proved to be the solvent for loyalty; the ten tribes in the north of Palestine revolted from the house of David, asking, "What part have we in Jesse?" and crying, "To your tents, O Israel." From this moment began not only a disunion, but a hostility, that proved the death-wound of the Israelitish power. A king reigned in Jerusalem over the tribes of Judah and Benjamin,

and was called the King of Judah, while "the son of Nebat" made Israel to sin in the country north of Judah, and established in his capital of Samaria, and in all the high places, an idolatrous worship of the gods of the surrounding nations. He was called the King of Israel.

Between the two kingdoms the most bitter rivalry prevailed—a rivalry which was perpetuated down to the time of our Lord himself, when it might have been thought that the common subjection to a common enemy—the Roman—would have wiped out the enmity anciently existing between them. This enmity showed itself in wars, in secret machinations of each against the other's interest, and in a dissension which ultimately proved the downfall of both the divided kingdoms. Instead of combining, as a chosen people should have done, against the assault of foes not only to themselves, but to the God who was their ancient Lord, they strove which should be the greater, and alike disregarded the warning voices which that God sent from time to time to admonish them of the evil of their ways. Israel from the first seemed to think that revolt from the King of Judah involved also revolt from the God of Judah, and accordingly instituted a worship of images and of the god Baal, which form so many denunciations in the prophetic writings. A continuous line of princes who defied as it were the God of their fathers, and a line hardly so continuous, of prophets who testified to the wrath of God against the children of disobedience—this is the sight presented to the student of Israelitish history during many decades of years. Intrigue, rebellion, murder—these were the concomitants of the royalty of Israel, and the outcome of the religion which the people picked up from the surrounding nations. Under Jeroboam Israel was made to sin, and under his successors continued to do so, now more, now less; now excelling in wickedness as under Ahab and Jezebel, and Jehoram; now appearing to strive for a while, as under Jehu, to enter in at the strait gate. The faithfulness of Elijah and of Elisha in testifying to the God of Israel was exhibited in vain before them; in vain were wonderful miracles wrought by Elisha in their sight; in vain were the national enemies driven back from the land by the direct interposition of the Almighty. Given over to "do evil in the sight of the Lord," king and people no more regarded the law of their God than their forefathers had done when the Divine presence was daily with them. They early forsook the temple of Jerusalem, and so severed the one common link that bound them to Judah. On Mount Gerizim they built a rival temple to that of Solomon, and used it as occasion served for the honour of Jehovah or of Moloch. Occasionally, but rarely, there was peace between Israel and Judah. Alliances were broken as soon as made, by the spirit of jealousy which animated either people, and by the want of real community of interest. Sometimes the two states combined to resist the encroachments of a Syrian king or a Ninevite ruler, and learned in adversity to remember Him who had wrought such wonderful things in their behalf. But secret disagreement, if not open hostility, was the chronic relation between the brother kingdoms; and when the measure of Israel's sin was full, and Shalmaneser smote Israel with the sword and took away the people captives beyond the Euphrates, Judah stood aloof, and witnessed the overthrow of his brother with calmness if not with satisfaction. The children of Israel were scattered abroad, Assyrian colonists were thrust into their pleasant places, and the throne of Samaria was held as tributary to that of Assyria by a lieutenant of the foreign king. In the year B.C. 719 the kingdom of Israel was thus destroyed, and was never reconstructed.

The kingdom of Judah survived, a small but compact state—a sort of Belgium—owing its existence, humanly speaking, to the jealousy of the great kings of surrounding nations, who could not annex it without exciting wars which for many reasons they could not afford. At the same time its advantageous geographical position, its good seaboard, and its great natural strength, made it a most desirable place to have and to hold. It was clear that its annexation must come sooner or later, being dependent only upon the balance of power abroad being destroyed by the overthrow of one of the great empires and the domination of another. Judah was to learn, as Israel had learned, that it is not in princes that trust must be placed; was yet to learn—has yet to learn—that until she can choose as her king, not Saul, not David, not Solomon, nor another, but Him whose royal authority she renounced these many centuries

ago, there is no rest for the soles of her feet, no slumber for the temples of her head. As a purely secular state, having kings like other nations, she was weak in spite of the culture of her people, a standing temptation to the great princes of the East to swallow her up. The history of her wars, of her domestic troubles, of her subjection, recovery of independence, and final deletion as a power, is a history full of general interest, and in some parts full of pity; but it is the history of a people with whom the student can feel little particular sympathy, of a people who seem to have provoked so thoroughly the wrath that came upon them as almost to make one approve the acts of enemies in themselves reprehensible.

Egypt, Babylon, Syria—these were the states against which Judah had, at various times to contend. The Edomites, Philistines, and Ammonites were lesser foes, let loose upon her from time to time, with the intention apparently of bringing her back to her allegiance through the medium of sorrow. Heedless of the warnings given to her, thankless for help lent, she was allowed to accomplish the sum of her transgressions by crucifying the King to whom she had looked forward for redemption. The Prince whose coming had been foretold with increasing distinctness by prophet after prophet, the assurance of whose coming had been the comfort of the people when by the waters of Babylon they sat down and wept, was betrayed by his friends and put to death by his subjects, who could not recognise him through the mist which centuries of disobedience and unfaithfulness had cast before their eyes. Scattered throughout the world, no more a nation though a people, the Jews still hesitate to ask for the King who shall reign over them. When the Jews are assured that the kings they have had, from Saul to Caesar, were no kings, and acknowledge the wrong their fathers did in renouncing the King of kings, looking upon their punishment through these long ages as a just retribution, they will be restored to their own land. Later on it is to be hoped, in God's own time, they will recognise the means by which the days were shortened so as to allow of the remnant, which they represent, being saved. As it is; they sing the Lord's song in a strange land.

MECHANICS.—XII.

THE PULLEY.

In the machines we have so far considered, the essential parts were rigid. It was a beam, or a spoke, or a complete wheel, or an axle we had to deal with; and if a rope was used, it was only with a view to connecting the power or resistance with these rigid parts. But it may have escaped your notice that, in using a rope for this purpose you had fallen on a veritable machine. Such is the case; a rope is a machine—a most convenient machine—which possesses the peculiar property of not only transmitting a force from one point to another in its original direction, but also sending it, very little impaired, round any number of corners, into a corresponding number of successive new directions. This

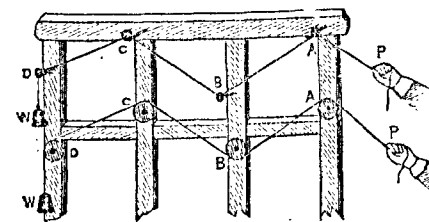


Fig. 67.

practical advantage everybody is familiar with; nobody more than the British sailor, whose daily work consists in no small degree in sending the muscular power of his arms round all manner of corners for the benefit of the good ship he navigates.

The Pulley, the third of the mechanical powers, is the instrument by which this object is gained in practice. In its simplest form it consists of a rope which passes round a small solid wheel which is itself mounted in a block. In theory, neither wheel nor block are indispensable parts of the machine; the single essential is the rope, which is supposed to be perfectly flexible, and to turn round a mere point without experiencing any resistance from rubbing against it, that is, from friction.

The theory of the pulley, thus based on the suppositions of perfect flexibility and absence of friction, may be understood

from the upper part of Fig. 67. Let A, B, C, D, be any number (say four) of rings, representing so many points, through which a rope passes, enabling a force, P, at one end to balance a resistance, W, at the other. The flexibility being perfect, and no friction between rope and ring, P is transmitted unimpaired, and we have therefore the power equal to the resistance, whether the rings are all fixed in position, or some be movable.

Fig. 68.

But in practice, the suppositions made do not hold good, neither is the rope perfectly flexible, nor the friction nothing. For the former reason each corner must be rounded off to relieve the rope from the sharp bends at A, B, C, D; and for the latter, these rounded corners are made into small wheels, as at E, F, G, H, which move round with the rope, and prevent the power being diminished by the friction that would result, were the rope allowed to slide round them. Thus the theoretical pulley in the upper part of Fig. 67 becomes the practical one in the lower, where the rings are replaced by wheels; and though some friction remains, and default of flexibility to impair P in its transmission, we say practically, as we did before theoretically, that still the power is equal to the resistance.

Fig. 69.

The relations of the power and resistance in the various forms and combinations of pulley can now be easily determined. There is first the Single Pulley, which is of two kinds, fixed and movable; and of these in various combinations, the more complex forms, termed Compound Pulleys, are made. At a, Fig. 68, we have a single fixed pulley, round which a rope passes, to the extremities of which the power and resistance are applied. The rope being equally strained on both sides, these forces must be equal; but, as both pull in the same direction downwards, the strain on the beam which is their resultant is twice as much as either the power or the weight, that is, double the resistance.

At b, in the same Fig., is the Movable Pulley, sometimes termed a "Runner." The rope attached at one end to the rafter above is thence carried downwards and round the pulley, and the power is then applied acting upwards, to the other end. At c is another form of this Runner, but the power is a weight, P, acting downwards, but round a smaller fixed pulley, producing thus the same effect as at b. In both these the forces are parallel, and the weight is evidently double the strain on either string; whence, since the power is manifestly equal to the strain, we infer that the power is equal to half the resistance, or weight raised.

If the two portions of the rope be not parallel, as in the movable pulley represented at Fig. 69, the resistance, W, is equal and opposite to the resultant of the two equal strains on the portions of rope attached to the hook a, and turning round the fixed pulley b. The angle between these portions is bisected by the vertical line wt; and if we measure on the rope wb, a portion, wg, equal to the power, and draw from g a line, gt, perpendicular to wt, to meet that line in t, twice wt will represent the resistance.

LESSONS IN LATIN.—XXXIV.

DEVIATIONS FROM THE MODEL CONJUGATIONS.

The four conjugations are only so many classes into which Latin verbs are put. These classes are determined by the tokens already stated, and the verbs in them are formed according to the models already given. But the verbs which make up these classes do not exhaust the whole stock of Latin verbs. There are others that more or less depart from the models. The verbs that depart from the models may in

general be ranked under three descriptions. 1. They differ from the model verbs in the perfect and the supine. 2. They differ from the model verbs in other parts. 3. They lack several parts which are possessed by the model verbs. As these three classes do not conform to the rule or standard afforded in the four conjugations, they might all be termed irregular. The epithet *irregular*, however, is commonly applied only to the second class, and as no good reason compels us to depart from the ordinary usage in this case, we shall specially apply the denomination of "the irregular verbs" to those verbs which differ from the models in other parts than the perfect and the supine. The verbs which differ in the perfect and the supine may be called *deviational*, as in a marked way deviating (de, from, and via, a way) from the ordinary forms; and those that are without certain parts may be termed *defective* (de, from, and facio, I make). Thus we obtain four classes of verbs:—

1. The *regular*, or those which mainly follow the paradigms of the four conjugations.
2. The *deviational*, those that depart from those paradigms in the perfect tense and the supine.
3. The *irregular*, those that depart from the paradigms in other parts.
4. The *defective*, those that are wanting in mood, tense, and person.

The verbs that follow the forms of the four conjugations are dignified with the term *regular*, because such verbs exist in greater number than any other class. The same facts may be set forth in this

VIEW OF THE LATIN VERBS.

Regular.	Irregular.
The Four Conjugations.	1. Deviatonal. 2. Irregular. 3. Defective.

The departure from the models would be very much lessened, were we at liberty to enter at length into the processes by which the present tenses now in use were formed, and exhibit the real roots or stems of the several verbs. In the restricted space, however, here at our disposal we can only give one or two instances. Take *sino*, I suffer, or allow. You think the stem to be *sin*. It is not so; the *n* is introduced into the present merely for the sake of strength in pronunciation. The stem is *st*. *Sis* would be a weak sound, two vowels coming together; and the Latins preferred saying *sino*. From *si*, however, is regularly formed both the perfect and the supine, thus: *si*, *si-vi*, *si-tum*. Take *rumpo*. Here, to obtain the stem, you must elide the *m* (that is, *n* which before *p* becomes *m*), and you have *rup*, from which are regularly formed *rup-i* and *rup-tum*. In *cresco*, you must in the same way leave out *sc*, and thus getting *cre* as the stem *cre*, you form the perfect by adding *vi*; for example—*cre-vi*. I subjoin similar instances: *sue-sc-o*, *sue-vi*; *pa-sc-o*, *pa-vi*; *no-sc-o*, *no-vi*; so the supines, *cre-tum*, *sue-tum*, *pa-tum* (the *s* of the present is retained before the *t*), *no-tum*. *Disco* represents a peculiar class of verbs; namely, those that form the perfect by what is called reduplication; that is, the repetition of the initial consonant with a connecting vowel, thus: *disco*, *discere*, *didici*; the root is properly *dic*; *dic-sc-o*, *dic-di-ci*. Having given these intimations, and inviting our pupils in due time to follow the thread, we now resume the order of the four conjugations, and shall set forth the principal deviations from the model forms.

I. DEVIATIONS IN THE FIRST CONJUGATION.

1. The Perfect with Reduplication.

i. Do, *dēdi*, *dāre*, *dātum*, to give; the *a* is short in the stems, as *dābam*, *dābo*, *dārem*, except *das* and *dā*. According to do form the compounds of *do*, of which the first part is a dissyllable, as *circundo*, *circumdēdi*, *circumdātum*, *circumdāre*. The compounds of *do* having monosyllables as prefixes follow the third conjugation, as *addo*, *addēre*, *addidi*, *additum*. It is not uncommon for a verb of one conjugation thus to pass into another conjugation.

ii. *Sto*, *stēti*, *stāre*, *stātum*, to stand (with *abl.* to cost). The compounds with monosyllables have in the perfect *stīti*, as *consto* (I consist of), *constiti*, *constare*; participle future active, *præstaturus*, *constaturus*, *obstaturus*, etc. The compounds with dissyllables retain *stēti*, and have neither supine nor participle future active; also *circumsto* (I stand around), *circumstēti*.

VOCABULARY.

Certo, certainly.	Extrinsēcus, adv., out-wardly.	Præsto, præstiti, præstatum, and præstitum, to stand before, to be distinguished (with <i>dat.</i> to hope).
Circundo, circumdēdi, circumdātum (dat. and acc. or acc. and <i>abl.</i>), to surround (some one with something), or to put something round some one.	Forum, -i, n., a market.	Præstare se fortem, to show oneself brave.
Classis, -is, f., a fleet.	Inspersans, -antis, hoping nothing, against hope.	Propugnator, -ōris, m., a defender.
Conservatio, -ōnis, f., preservation.	Interfector, -ōris, m., a slayer, murderer.	Stipendium, -i, n., pay.
Consto, constiti, constare, constātum, to consist of (<i>abl.</i>), to cost.	Invitus, -a, -um, unwilling.	Uber, ubēris, rich.
	Obsto, I stand in the way of, hinder.	Vestis, -is, f., a garment.
	Persto, perstiti, perstare, perstātum, to continue.	

Observe that a noun or pronoun may be governed in the ablative case by an adjective in the comparative degree; thus:—

Noun.	Aurum est gravius argento.
	Gold is heavier than silver.
Pronoun.	Lux quæ nihil est carius.
	Light than which nothing is dearer.

This is a kind of abbreviated comparison. If the fuller form with *quam* were used, then the noun after the *quam* would be in the same case as that before *quam*: for example:—

Full form.	Nihil est divinius quam clementia.
	Nothing is more divine than mercy.

EXERCISE 125.—LATIN-ENGLISH.

1. Deus nobis dedit animum, quo nihil est præstantius. 2. Multo sanguine nobis victoria stetit (cost, so we say stood in). 3. Mater omnium bonarum artium sapientia est, quæ nihil a Deo immortaliter uterius, nihil præstabilius hominum vite datum est. 4. Deus corpus, ut quondam vestem, animo circumdedit, et vestivit extrinsēcus. 5. Quorum patres aut majores aliqui gloriā præstiterunt, (ii) student plerumque eodem in generis laudis excellere. 6. Parentes carissimos habere debemus, quod ab iis nobis vita tradita est. 7. Non dedit beneficium, qui invitatus profuit. 8. Quinam magis sunt tui quam (ii) quibus tu salutem insperantibus reddidisti? 9. Cives acerrimos propugnatores libertatis se præstiterunt. 10. Ingenium hominum multitudo oratorem in foro circumstetit. 11. Eloquentia ad salutem hominum data est a naturā. 12. Eloquentia ad conservationem hominum data est a naturā. 13. Malus orator eloquentiam ad bonorum pestem, perniciemque convertit. 14. Quid est tam inhumanum quam eloquentiam, a naturā ad salutem hominum et ad conservationem datam, ad bonorum pestem, perniciemque convertere? 15. Stipendium ex longo tempore militibus non erat datum. 16. Seditio inter milites orta est. 17. Quum stipendium ex longo tempore non esset datum, seditio inter milites orta est. 18. Tu mi amice, mihi fidem præstaturus es. 19. Certo scio te mi amice, mihi fidem præstaturum esse. 20. Nihil nobis obstat. 21. Nihil nobis obstatum est. 22. Victoriā adipiscamur. 23. Credo, nihil nobis obstatum esse, quominus victoriā adipiscamur. 24. Victoria constitit multorum fortium virorum morte. 25. Non dubitabamus quin multorum virorum fortium morte victoria constaturus esset. 26. Perstaturus ne es in sententiā tuā? 27. Nescio perstaturus ne sis in sententiā tuā.

EXERCISE 126.—ENGLISH-LATIN.

1. He gave the general a fleet. 2. He will give thee a fleet. 3. Dost thou think that he is about to give a fleet to my brother? 4. Nothing has cost men more (pluris) than avarice. 5. God has given me a sister, than whom nothing is dearer to me. 6. My sister will show herself loving to me all her life (acc. with per). 7. The soldiers showed themselves very brave, but the victory cost the death of many brave men. 8. Nothing hinders our gaining the victory (hinders, lest we should gain, stands in the way to prevent our gaining the victory). 9. I believe we shall gain the victory. 10. Socrates surpassed all philosophers. 11. Who does not know that Socrates surpassed all philosophers? 12. Dost thou believe that thy son will surpass all his equals? 13. A great multitude surrounds the orator. 14. Pay has not been given to the soldiers. 15. I will give pay to the soldiers. 16. Take care lest seditio arise among the soldiers. 17. Wilt thou persist in thy opinion? 18. I do not know whether I shall persist in my opinion.

It may be desirable to illustrate more fully the construction of *circumdare* and *quominus*.

CONSTRUCTION OF "CIRCUMDO."

1. Aliquid alicui rei, that is, a nominative or accusative of the thing with a dative of the thing. 2. Aliquem or aliquam aliquā re, that is, an accusative of the person or thing, with an ablative of the thing.

1. "Aer omnibus est rebus circumdatus."—Lucretius.
Lit. Trans.—"The air to all is to things surrounded."
Id. Trans.—"All things are surrounded with air."

1. "Tectis ignes circumdatos restinximus."—Cicero.
Lit. Trans.—"To the roof fires put round we extinguished."
Id. Trans.—"We extinguished the fires which had been set to the houses."
2. "Oppidum vallo et fossa circumdedit."—Cicero.
Lit. Trans.—"The town with a rampart and ditch I have surrounded."
Id. Trans.—"I have surrounded the town with a rampart and ditch."
3. "Circumdato me brachiis."—Plautus.
Lit. Trans.—"Surround me with arms."
Id. Trans.—"Put thy arms round me."

CONSTRUCTION OF "QUOMINUS."

Quominus is made up of quo, in order that or so that; and minus, less (least, lest) or not; consequently, quominus is equivalent to *so that not*; a more simple way is to render it by *to prevent*. Quominus takes a subjunctive mood. If you use "to prevent" you must in English use also the idiomatic construction of "to prevent;" but in putting that construction back into Latin and so employing *quominus*, you must employ, of course, the proper Latin construction; as in the following example:—

"Nihil do me talistis quominus in civium essem numero."—Cicero.
Lit. Trans.—"Nothing from me you bore so that not in of the citizens number I should be."
Id. Trans.—"You got nothing from me to prevent my being in the number of the citizens."

VOCABULARY.

Brachium, -i, n., the arm.	Collum, -i, n., the neck.	Latus, -a, -um, broad.
Cancelli (cancellorum), m., limits (E. R. chancellor, chancellor, chancellor).	Fautor, -ōris, m., a patron, favourer.	Lectus, -i, m., a bed.
	Impedio, -i, m., I hinder.	Repugno, -i, I fight against (E. R. repugnant).
	Interpello, -i, to question.	

EXERCISE 127.—LATIN-ENGLISH.

1. Nihil impedit quominus id quod maxime placeat facere possimus. 2. Non repugnabo quominus omnia legat. 3. Mors non deterret sapientem quominus reipublicæ consulat. 4. Interpellent me quominus honoratus sim, dum me interpellent quominus reipublica a me commode administrari possit. 5. Nemini civi ulli, quominus addeset, satis justa excusatio est visa (no pretext appeared sufficient to excuse any citizen from being present). 6. Fossam latam lecto circumdedit. 7. Exercitum circumdat hostium castris. 8. Circumdat sibi milites. 9. Circumdabit brachia collo tuo. 10. Circumdedit urbem tumulo. 11. Extra hos cancellos egredi conabor quos mihi ipse circumdedit. 12. Egregiam famam paci circumdedit (gave to, invested with). 13. Fautores illi hanc famam circumdederunt.

EXERCISE 128.—ENGLISH-LATIN.

1. Nothing hinders you from being a good boy. 2. I will surround thee with fame. 3. He will put a garment round me. 4. He has surrounded his sister with honour. 5. Surround the city with fire to prevent the citizens from going out. 6. That is no excuse for your absence.

KEY TO EXERCISES IN LESSONS IN LATIN.—XXXIII.

EXERCISE 117.—LATIN-ENGLISH.

1. Cæsar feared to oppose his army to a river of such magnitude. 2. Cæsar is of opinion that it should be attempted, and a trial made. 3. Cæsar, although he feared to oppose his army to a stream of such magnitude, yet is of opinion that it should be attempted and a trial made. 4. Nor did they fear that they should be surrounded. 5. They said that they feared not the enemy. 6. They said that they feared the narrow road. 7. They said that they feared that corn was not supplied conveniently enough. 8. They said that they feared not the enemy, but the narrow road; and that they were afraid that provisions could not be supplied conveniently enough. 9. Be not afraid, the ship is safe. 10. I fear greatly on account of the republic.

EXERCISE 118.—ENGLISH-LATIN.

1. Timeo ne operam perdidideris. 2. Timeo ne domus cadat. 3. Timeo ut frumentum in urbem supportetur. 4. Dux metuet ut exereitus ejus veniret. 5. De suâ puellâ pulchrâ metuunt. 6. De fortunâ tuâ nihil timeo. 7. Rex ducesque timeat ne circumveniantur. 8. Cicero experiendum judicat. 9. Timeo ut experiiri possit.

EXERCISE 119.—LATIN-ENGLISH.

1. The forehead, the eyes, and the countenance often lie, but the speech lies very often. 2. Whatever arises has its origin from nature. 3. The sun bestows the same light and the same warmth on all. 4. How many are unworthy of light! and yet the day arises. 5. Whence, at length, do you appear to us so suddenly? 6. O soldiers, if we break out in fierce assault upon the enemy, the victory is in our hands.

7. While we attempted to assault the city, the enemies attacked us from behind. 8. Each one measures dangers by his own fear. 9. The wise man both remembers past things with pleasure, and so possesses present things as to perceive how great and how pleasant they are. 10. Take care you do not obtain honours by flattery. 11. Orators, before they begin, premise certain things. 12. In all matters, before we begin, we should employ careful preparation. 13. All the citizens had adorned and clothed their houses with flowers and wreaths, because they were waiting for the king. 14. While the hostile army was demolishing the private and public buildings of the city, the citizens were filled with the greatest grief. 15. While the enemies were dividing the spoil amongst themselves, we charged them with the greatest impetuosity. 16. The general exhorted the soldiers, that they should try all methods by which they might relieve the city from the blockade.

EXERCISE 120.—ENGLISH-LATIN.

1. Sava tempestas coorta est. 2. Sava tempestas coorietur. 3. Sava tempestas cooritur. 4. Sava tempestas cooriebatur. 5. Sava tempestas cooriebatur. 6. Nautæ multos labores experti sunt. 7. Hostes domum tuam demolientur. 8. Meam sororem opperiar. 9. Mater mea heri me opperiebatur. 10. Illi eblanditi sunt honores. 11. Honores eblandieris? 12. Nolo honores eblandiri. 13. Prius quam ordiaris, adhibenda tibi est industria. 14. Tellure potitur. 15. Omni urbe potitus est. 16. Libris patriæ mei potiar. 17. Mi puer, cave ne mentiaris. 18. Solum mali mentiantur. 19. Malum est mentiri. 20. O pater, nunquam mentiar. 21. Illi mentiti et puniti sunt. 22. Turpe est mentiri. 23. Sol et bonis et malis oritur, tanta bonitas Deo est. 24. Rex fortibus militibus honores largitur. 25. Inter duo filios bona partitus est. 26. Quicquid a tellure oritur, venit a manu divinâ.

EXERCISE 121.—LATIN-ENGLISH.

1. Those are to be laughed at who teach others that which they themselves have not tried. 2. Every animal loves itself, and as soon as it appears, aims at preserving itself. 3. Nature has bestowed so great a productive power on the conveniences and necessities of men, in order that those things which are begotten may seem to have been given to us advisedly, and not to have arisen by chance. 4. Herodotus passed through many lands, and certainly related many marvellous things, but these he himself invented not, but others (invented them) from whom he heard them. 5. Now for three months we had been waiting for a friend, when his death was announced to us. 6. Sulla suddenly appeared to the Romans, and began a most frightful civil war. 7. A wise man will never flatter bad men, never invent any false thing, never occasion injury to others. 8. If we attack the enemy quickly, there is no doubt that in a short time we shall get possession of the city. 9. As soon as the sun has risen, we shall set out. 10. Take care that you do not flatter bad men. 11. The enemies hastened to get possession of the city. 12. An even number is easy to divide. 13. The sun rising, we set out. 14. A fierce tempest having arisen, great fear seized all the sailors. 15. With the greatest pleasure we behold the sun when about to rise.

EXERCISE 122.—ENGLISH-LATIN.

1. Sole oriente, tenebræ diffugiunt. 2. Solem orientem magnâ cum voluptate specto. 3. Coorta tempestate, naves nostras sparant. 4. Nulli calamitatem molior, non etiam malis. 5. Ortus est sol? 6. Hora octavâ sol orietur. 7. Repente hostem adortus est. 8. Meam ordiar orationem. 9. Orator orationem ordiebat, quum judex intrabat. 10. Non est dubium quin tuis potituris sitis. 11. Simulacra nati sumus, movemus. 12. Omnes homines se ipsos diligunt, ac simulacra facultatibus potiti sunt, inter se eas partiri debent. 13. Inter agentes facultates partitus est. 14. Multi Britanniam emensi ignorant quam sit felix potensque. 15. Spero te nunquam mentiturum esse. 16. Tempestas orietur. 17. Omnes existimant, tempestatem cooriturum esse.

EXERCISE 123.—LATIN-ENGLISH.

1. The arts support themselves. 2. We shall always pity wretched men. 3. When you are sick, you ought to comply with the instructions of the physician. 4. Foolish men perceive the faults of others, (but) forget their own. 5. The principal charm of youth springs from modesty. 6. O boys, reverence old age. 7. O boy, I confess the truth. 8. Take pity on the destitute. 9. Let the scholars reverence their teachers. 10. I doubt not that you will promise me your protection. 11. We behold with great pleasure the noble examples of virtue which have been recorded in history. 12. Who knows not how many abuse eloquence? 13. We have enjoyed peace during many years. 14. All the citizens fear that the enemies will attack the city. 15. As soon as we have arisen, we proceed to our business. 16. The citizens, having obtained liberty, will enjoy the greatest pleasure. 17. Aid the fallen. 18. Converse as boldly with your friend as with yourself. 19. Be not angry with those whom you ought to love. 20. If we always pursue the path of virtue, access to heaven will sometimes lie open to us. 21. Perform your part well. 22. By concord, small things increase; by discord, the greatest things fall to pieces. 23. Glory, like a shadow, follows virtue.

(For Key to Exercise 124, see next Lesson.)

GEOMETRICAL PERSPECTIVE.—XI.

PROBLEM XXXIII. (Fig. 55).—A stone slab is inclined at an angle of 35° with the ground; it is resting on an edge of one of its ends, which is parallel with the picture plane; the edge on the ground is 4 feet within; length of slab 9 feet; breadth 8 feet; thickness 2.5 feet. Height of the eye 4 feet; and distance from the PP 8 feet.

Although the slab is on an incline, yet its ends are parallel with the PP, therefore it may be considered a case of parallel perspective; had it been flat on the ground, its vanishing point would have been the PS; but being an incline of 35° its VP is perpendicularly above the PS, found by drawing a line at 35° with the HL from PS (we hope our pupils now clearly understand that the vanishing lines for inclinations are always drawn from the PP of the VP, to which they would retire if they were horizontal; we beg them to turn back and examine the figures of the previous problems to confirm this). The first thing to be done is to find the point b within the picture; make ca and cd each equal to 4 feet (these distances are together equal to the width of the slab); and as b is 4 feet within we will use the point a again, and rule a line to VP^1 ; where this line cuts the line cs gives the point b ; join ds and as ; through b draw ef . Now, as the face and end of the stone are at right angles with each other, it is very evident that if the vanishing line of the face is at VP^1 , the vanishing line of the end must form a right angle with it and terminate at VP^2 . Find VP^2 , and its distance point DVP^2 ; through d draw the perpendicular hgm . Now we must draw the end of the stone $oepf$ thus: because it vanishes at VP^2 , therefore we must draw a line from DVP^2 through e to the measuring line in h ; mark off the thickness of the stone 2.5 feet from h to g , and rule g back again to DVP^2 ; this gives the perspective thickness of the slab o directed to VP^2 . To obtain the opposite corners p, f will present no difficulty; from e draw to VP^1 , and from the distance point of VP^1 draw a line through e to m on the measuring line; make mi equal to the length of the slab; a line from i to DVP^1 will cut the vanishing line e to VP^1 in n ; draw ns towards VP^2 , and st meeting a line from p to the VP^1 , this will complete the

perspective of the slab. We will now draw the same slab not having any of its sides parallel with the PP.

PROBLEM XXXIV. (Fig. 56).—The slab of the last problem, having the same dimensions; the position only different; one of its edges is at an angle of 40° with the PP; the remaining conditions as before.

Draw the HL, BP, distance E and semi-circle. Find the VP for the end, viz. VP^1 , by a line from E at an angle of 40° with the tangent line. VP^2 is found by drawing a line at a right angle with EVP^1 ; draw EP^2 ; b is the distance of the nearest point within, determining a (remember DE is the distance point for cutting the line EP^2 to find a). The vanishing point for the face of the slab will be VP^3 , found by drawing a line from DVP^2 at an angle of 30° ; VP^4 will be the vanishing point for the end. For their distance points, draw from VP^1 , with a radius to DVP^1 , an arc to DVP^4 . From VP^3 , with a radius to DVP^3 , draw an arc to DVP^2 . To draw the horizontal edge ao , draw a line from a to VP^1 ; draw from DVP^1 through a to g ; make gh equal to the width; from h rule back again to DVP^1 , giving the required length of the end ao . Through a draw from DVP^4 to e on the measuring line, ef is equal to the thickness of the slab; draw from f to DVP^4 , and through a directed to VP^4 draw a n ; draw from n to VP^1 . Through o draw op directed to VP^4 ; this will be the end of the slab. Draw from a to VP^2 ; through a from DVP^2 draw a line to i ; make im equal to the length of the slab; draw from m back again to DVP^2 , this will produce a r . Draw a line from n to VP^2 for the inclined edge. A line directed from VP^1 through r , meeting the line from n to VP^2 in s , will be the termination of the length. From s to t , directed to VP^1 , will be the upper edge of the face of the slab.

If these two problems upon the same slab, in the same position, and having the same dimensions, but viewed from different points, are well studied, with regard to that especial reason which suggested their introduction—viz., the principle of finding vanishing points for inclined lines and planes, and the method of treating them according to the characters and proportions of the objects, and the view we have of them—they will help to make our future problems possessing more details easy to be understood.

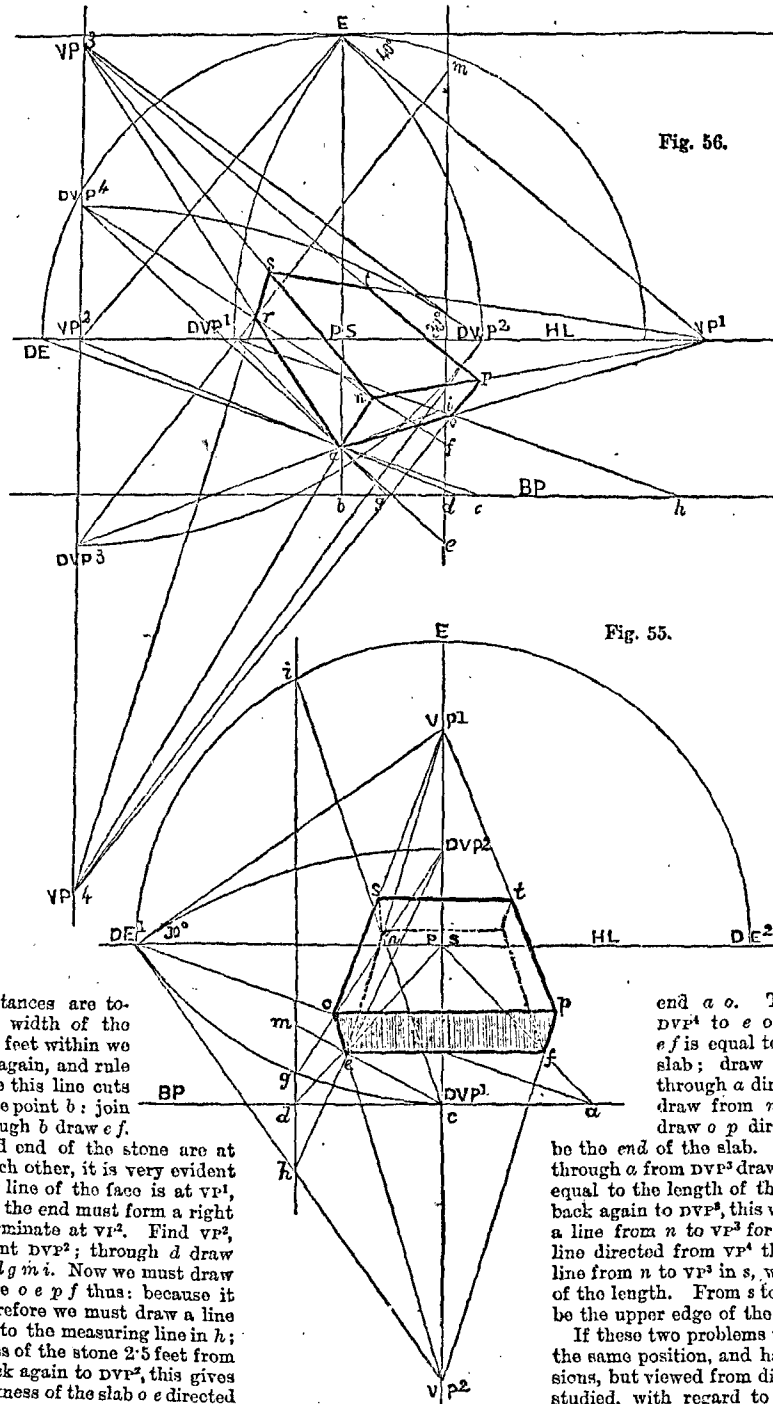


Fig. 56.

Fig. 55.

LESSONS IN ENGLISH.—XXXV.

LATIN STEMS (continued).

I MAY now give an instance or two of curious etymologies. Husband is said to be house-band, the band and bond of the house. This view is indicated in the couplet—

"The name of the husband what is it to say?
Of wife, and the household, the band and the stay."
Tusser, "Points of Husbandry."

Tariff, a fixed scale of duties levied on imports, comes, it would seem, from *Tarifa*, the Moorish name of a fortress standing on a promontory, on which, as it commanded the entrance of the Mediterranean, a custom-house was erected. A saunterer is one who wiled away his time in La Sainte Terre, the Holy Land, after the first enthusiasm of the crusades had gone off, and pilgrimages became a sort of religious fashion for the idlers of the day. A poltroon (from the Latin, *pollice truncus*, deprived of his thumb) is one who through fear has cut off his thumb rather than go to war: such mutilations are still not unknown. From poltroon, in French *poltron*, some derive *palter* and *paltry*. The word *post* may well claim a place among etymological curiosities. *Post*, coming from the Latin *positus*, placed, may signify a stock placed in the ground, a post; or such a stock (or something like a post), with a hole in it to receive letters; hence, a post or post-office: it may also be applied to a military station, because a person or persons are posted, that is, placed at the particular spot to keep and defend it. Hence it is easy to see how the epithet may be applied to horses or carriages, as post-horses, post-chaise, and posting-house, because at that house horses and carriages were placed for hire; and as persons travelling from posting-house to posting-house would naturally, as being away from home, and intent on some business, probably business of an urgent nature, make all possible speed, so to *post* and to travel *post-haste*, came to signify rapid travelling. Thus a post, a wholly stationary and immovable thing, came by natural deviation and easy steps to represent the utmost speed in travelling known before the laying down of railways.

If we fix our eye on the etymology of words we shall, in some cases, become aware of marked incongruities. What, for instance, shall we say of calling a weekly newspaper a *journal* (French, *jour*, a day)? I have even seen a *Journal of Sacred Literature* which made its appearance every three months. So a journeyman is one who works under a master, though to appearance he is a day-labourer. To adjourn is properly to hold meetings from day to day, whereas now it signifies to break up an assembly, or to fix some time in the future for coming together again.

"An adjournment is no more than a continuance of the session from one day to another, as the word itself signifies."—Blackstone.

False spelling has been the parent of false etymology. A country-dance is not a dance in the country, but a *contre danse*, a dance where each one stands opposite to his partner in the long line of couples; the French term *contre* signifying opposite. *Shamefacedness* and *shamefaced* have properly nothing to do with the face or countenance, but are misspellings under a false notion for *shamefastness*, and *shamefast*, like *steadfast* and *steadfastness*. Hurricane is in origin, whatever it may be in fact, totally innocent of hurrying away the canes of the sugar plantations in the West Indies, and comes to us from our Gallic neighbours, who, borrowing an Oriental term *uracan*, to describe an Oriental storm or tornado, designate it *ouragan*.

The alligator, or crocodile of the New World, was very appropriately designated by the Spaniards who first saw it, *el lagarto*, that is, the lizard, the lizard, the largest lizard, the type of the lizard species. In time the article *el*, the, blended with the noun and formed *alligator*. We have a similar combination in *Eldorado*, the gold country. In Ben Jonson, who writes *aligarta*, we see the word in the process of its transformation. For this word Dr. Johnson could find no etymology, and Sir T. Herbert made it to be a compound of German and Spanish.

LATIN STEMS.

Latin Words.	Meanings.	Stems.	English Words.
Unus	one	un, uni	unanimous, uniform.
Urbs	a city	urb	urban, suburb.
Ustus	burnt	ust	combustion.
Utilis	useful	util	utility.
Uxor	a wife	uxor	uxorious.
Vacca	a cow	vacc	vaccination.
Vaco	I am empty	vac, vacu	vacation, vacancy, evacuate.

Vado	I go	vade, vas, vad	invade, invasion, vade.
Vagor	I wander	vag, vagr	vagabond, vagrant.
Valco	I am strong	val, valil	valid, prevalent, prevail.
Vasto	I lay waste	vast, vastat	devastation, waste.
Veho	I carry	veh, vey	vehicle, convey.
Venio	I come	ven	convene, contravene.
Ventum	to come	vent	advent, convent.
Ver	the spring	ver	vernal.
Verto	I turn	ver	revert, convert, divert.
Versus	turned	vers	diverse, reverse, versatila.
Verus	true	ver	verity, aver.
Vestis	a garment	vest	vestment, invest.
Vetus (vetëris)	old	veter	veteran, inveterate.
Via	a way	vi	obviate, obvious.
Video	I see	vid	provide, invidious.
Visus	seen	vis	visible, vision.
Vigil	watchful	vigil	vigilant.
Teneo	I hold	ten, tain, tin	tenant, contain, continent.
Tentus	held	tent	detention, content.
Tenuis	thin	tenu	tenacity, attenuate.
Tepeo	I am warm	tep, tepe	tepid, tepidation.
Terra	the earth	terr, ter	terraqueous, inter, disinter.
Testis	a witness	test	testify, attest.
Textus	woven	text	text, texture, context.
Tollo	I lift up	tol	extol.
Tortus	twisted	tort	tortuous, extort, distort.
Traho	I draw	trah	subtrahend.
Tractus	drawn	tract	tractable, subtract.
Titus	rubbed	trit	trituration, attrition.
Trudo	I thrust	trud	intrude, detrude.
Trusus	thrust	trus	obtrusion.
Tueor	I look at	tuit	tuition, intuition.
Tutus	protected	tut	tutor.
Turba	a crowd	turb	turbulent, disturb.
Turpis	base	turpi	turpitude.
Uber	fertile	uber	exuberant.
Umbra	a shadow	umbr	umbrageous, umbrella.
Unda	a wave	und	undulate, inundate.
Ungo	I anoint	ungu	unguent.
Unctus	anointed	unct	unction.
Vinco	I conquer	vinc	invincible.
Victus	conquered	vict	victory, Victoria.
Vita	life	vital	vital, vitality.
Vivo	I live	viv	vivid, survive.
Victum	to live	viv	victuals.
Voco	I call	voc, vok	vocative, invoke, revoke.
Volo	I will, wish	vol	voluntary, benevolent.
Volo	I fly	vol	volatile.
Volvo	I roll	volv	revolve, devolve.
Volutus	rolled	volut	revolution, involution.
Voro	I devour	vor	voracious, carnivorous.
Vulgus	the rabble	vulg	vulgar, divulge.
Vulsus	pulled, torn	vuls	convulsion.

Inter and *disinter* may be compared with *inhumation* and *exhumation*. The four words are made up of Latin elements, but they are not pure Latin words. To *inhume* (inhumo) or to *put in the ground*, is good Latin, and the Romans practised inhumation; indeed, for a corpse to remain uncovered with earth was accounted a great calamity among them. But the practice of burial, to which these four words point, owes its origin and prevalence to the Christian Church, from the usages of which the words themselves are derived. The doctrine of the resurrection of the body made an article of the Christian's creed, and, entering into his heart and life, naturally led to the discontinuance of burning dead bodies, and to their being *inhumed* or *interred*, put into the earth, there to await their resurrection or rising again.

Umbrella, from *umbra*, a shade, is etymologically a little shade. *Umbrella* is a mediæval word used to represent a Greek word (*σκιάδιον*, skiad-ion) of the same import. Umbrellas are of Eastern origin. In Constantinople, under the Greek empire, they were used for the same purpose as our ladies now use parasols, namely, to shade the head and face from the heat of the sun. Such a protection was less needful in our cold moist climate, and doubtless the rough and sturdy manners of our old English forefathers were averse to a foreign fashion, and so (to them) effeminate. The use of the umbrella in the shape of a parasol found a home in France, and was made prevalent in this country probably by Catherine of Braganza, though it was known here before her time, as may appear from the following quotations:—

"I saw in the court of Spain once
A lady falling in the king's sight, along;
And there she lay, flat spread, as an umbrella."—Ben Jonson.

"Are you at ease now, is your heart at rest,
Now you have got a shadow, an umbrella,
To keep the scorching world's opinion
From your fair credit?" *Beaumont and Fletcher.*

The latter passage makes it very clear that the umbrella, at the time it was written, was intended not, as now, to keep off the rain, but to cover the face from the sun. But what are we to say of the description in the former quotation, in which it clearly appears that the umbrella was "flat" when "spread?" The explanation is offered in the fact that the first kind of parasol was a large fan. I cite a few words from Miss Strickland's "Queens of England" (Vol. VIII, p. 355): "The courtly belles used the gigantic green shading-fans which had been introduced by the Queen (Catherine) and her Portuguese ladies, to shield their complexion from the sun, when they did not wish wholly to obscure their charms by putting on their masks. Both the mask and the fan, or umbrella, were in general use in this reign. The green shading-fan is of Moorish origin, and for more than a century after the marriage of Catherine of Braganza was considered an indispensable luxury by our fair and stately ancestral dames, who used them in open carriages, in the promenade, and at prayers, when they ostentatiously screened their devotions from public view, by spreading them before their faces when they knelt. The India trade, opened by Catherine's marriage treaty, soon supplied the ladies of England with fans better adapted, by their lightness and elegance, to be used as weapons of coquetry at balls and plays. Addison has devoted several papers in the *Spectator* to playful satire on these toys, from whence the now general terms of flirt and flirtation have been derived."

Undoubtedly the practice of flirtation grew and prevailed in and before the days of Addison: but as to the origin of the word *flirt* Miss Strickland is in error. Derived from *to flier, flirt* or *flurt*, signifying a light and silly tossing, is of Saxon origin, and may be found in some of our earliest writers. This flirting of the fan is termed by Addison, *flutter*. The piece in which he describes this flutter is in his best style for quiet satire, and I shall therefore transcribe it as your lesson in composition, requesting you to send to some friend an account both of the ensuing and of my observations on the umbrella, the parasol, and the fan.

EXERCISE IN COMPOSITION.

MR. SPECTATOR.—Women are armed with fans, as men with swords, and sometimes do more execution with them. To the end, therefore, that ladies may be entire mistresses of the weapons which they bear, I have erected an academy for the training up of young women in "the exercise of the fan," according to the most fashionable airs and motions that are now practised at court. The ladies who "carry" fans under me, are drawn up twice a day in my great hall, where they are instructed in the use of their arms, and exercised by the following words of command:—

Handle your fans!
Unfold your fans!
Discharge your fans!
Ground your fans!
Recover your fans!
Flutter your fans!

By the right observation of these few plain words of command, a woman of tolerable genius, who will apply herself diligently to her exercise for the space of but one half-year, shall be able to give her fan all the graces that can possibly enter into that little modish machine.

But to the end that my readers may form to themselves a right notion of this exercise, I beg leave to explain it to them in all its parts. When my female regiment is drawn up in array, with every one her weapon in her hand, upon my giving the word "to handle their fans," each of them shakes her fan at me with a smile, then gives her right-hand woman a tap upon the shoulder, then presses her lips with the extremity of her fan, then lets her arms fall in an easy motion, and stands in a readiness to receive the next word of command. All this is done with a close fan, and is generally learned in the first week.

The next motion is that of "unfurling the fan," in which are comprehended several little flirts and vibrations, as also gradual and deliberate openings, with many voluntary fallings asunder in the fan itself, that are seldom learned under a month's practice. This part of the exercise pleases the spectators more than any other, as it discovers on a sudden an infinite number of cupids, garlands, altars, birds, beasts, rainbows, and the like agreeable figures, that display themselves to view, whilst every one in the regiment holds a picture in her hand.

Upon my giving the word to "discharge their fans," they give one general crack that may be heard at a considerable distance when the wind sets fair. This is one of the most difficult parts of the exercise;

but I have several ladies with me, who at their first entrance could not give a pop loud enough to be heard at the farther end of the room, who can now "discharge a fan" in such a manner that it shall make a report like a pocket-pistol. I have likewise taken care, in order to hinder young women from letting off their fans in wrong places or unsuitable occasions, to show upon what subject the crack of a fan may come in properly. I have likewise invented a fan with which a girl of sixteen, by the help of a little wind which is inclosed about one of the largest sticks, can make as loud a crack as a woman of fifty with an ordinary fan.

When the fans are thus "discharged," the word of command in course is to "ground their fans." This teaches a lady to quit her fan gracefully when she throws it aside in order to take up a pack of cards, adjust a curl of hair, replace a fallen pin, or apply herself to any other matter of importance. This part of the exercise, as it only consists in tossing a fan with an air upon a long table (which stands by for that purpose), may be learned in two days' time as well as in a twelvemonth.

When my female regiment is thus disarmed, I generally let them walk about the room for some time; when on a sudden, like ladies that look upon their watches after a long visit, they all of them hasten to their arms, catch them up in a hurry, and place themselves in their proper stations upon my calling out—"Recover your fans!" This part of the exercise is not difficult, provided a woman applies her thoughts to it.

The "fluttering of the fan" is the last, and indeed the masterpiece of the whole exercise; but if a lady does not mis-spent her time, she may make herself mistress of it in three months. I generally lay aside the dog-days and the hot time of the summer for the teaching this part of the exercise, for as soon as ever I pronounce—"Flutter your fans," the place is filled with so many zephyrs and gentle breezes as are very refreshing in that season of the year, though they might be dangerous to ladies of a tender constitution in any other.

There is an infinite variety of motions to be made use of in the "flutter of a fan": there is the angry flutter, the modish flutter, the timorous flutter, the confused flutter, the merry flutter, and the amorous flutter. Not to be tedious, there is scarce any emotion in the mind which does not produce a suitable agitation in the fan; inasmuch that if I only see the fan of a disciplined lady, I know very well whether she laughs, frowns, or blushes. I have seen a fan so very angry, that it would have been dangerous for the absent lover who provoked it to have come within the wind of it; and at other times so very languishing, that I have been glad, for the lady's sake, the lover was at a sufficient distance from it. I need not add that a fan is either a prude or a coquette, according to the name of the person who bears it. To conclude my letter, I must acquaint you that I have from my own observations compiled a little treatise for the use of my scholars, entitled "The Passions of the Fan," which I will communicate to you, if you think it may be of use to the public. I shall have a general review on Thursday next, to which you shall be very welcome, if you will honour it with your presence. I am, etc.

P.S. I teach young gentlemen the whole art of gallanting a fan.

N.B. I have several little plain fans made for this use, to avoid expense.

READINGS IN FRENCH.—XI.

J A C O P O .

SECTION I.

On aime à recueillir, comme un religieux souvenir, tout ce qui appartient (a) à la vie des hommes illustres. A ce titre l'anecdote suivante ne sera pas sans intérêt, car vous connaissez tous son principal héros: Napoléon!

Par un beau jour d'été, deux jeunes enfants, un garçon et une petite fille s'amusaient à courir dans un magnifique jardin d'Ajaccio en Corse. Tous les deux, armés d'un flot pour prendre des papillons, se livraient avec ardeur à la poursuite de ces jolis insectes.

C'étaient Napoléon, l'un des fils de Charles Bonaparte et de Letitia Ramolini, et la petite Elisa, sa sœur.

Les deux enfants se dirigèrent vers un bouquet (b) de lilas situé à l'extrémité du jardin, qu'une simple haie séparait de la campagne. Presque au même instant, les deux filets se posèrent (c) sur un branche où venait de s'arrêter un papillon; mais celui-ci, faisant un ricochet, s'échappa, et, s'élevant en zig-zags dans les airs, prend sa course par-delà la haie et s'élança dans la campagne.

"Ah! Napoléon, qu'est-ce donc que tu viens de faire?"

"Je viens de franchir un défilé pour gagner la bataille. Suis-moi."

Alors écartant les branches, prenant sa sœur par la main, il lui facilita le passage de l'autre côté du jardin. Libres alors, ils s'élançaient à la poursuite du fugitif et ne tardent pas à se

trouver en rase (d) campagne. Tout à coup, Elisa pousse un cri, dans son ardeur elle a heurté une petite paysanne qui portait au bras un panier rempli d'œufs; elle l'a renversée avec son fardeau, et les œufs brisés gisent (e) à terre.

"Sauvons-nous," (f) dit tout bas Elisa à Napoléon, "cette petite ne nous connaît pas; retournons vite à la maison, maman n'en saura (g) rien."

"Je ne me sauverai pas, moi," fit Napoléon: "je reste." Vois cette pauvre petite, comme elle se déssole; c'est nous qui sommes la cause du malheur qui lui est arrivé; c'est nous qui devons le réparer."

Elisa, honteuse, rougit et baissa les yeux; mais, comme elle avait bon cœur, elle s'approcha de la petite qui continuait à pleurer: elle essuya ses larmes, et se mit à ramasser les œufs qui n'avaient point souffert; hélas! plus des deux tiers étaient cassés.

COLLOQUIAL EXERCISE.

1. Qu'aime-t-on à recueillir?
2. Que dit l'auteur de l'anecdote?
3. Que faisaient les jeunes enfants par un beau jour d'été?
4. Que faisaient-ils de leurs filets?
5. Qui étaient les deux enfants?
6. Vers quel endroit se dirigèrent-ils?
7. Que firent-ils en même temps?
8. Prirent-ils le papillon?
9. Où s'en alla l'insecte?
10. Que dit alors Elisa?
11. Que lui répondit le jeune Napoléon?
12. Que fit-il en écartant les branches?
13. Où allèrent alors les enfants?
14. Que fit tout à coup Elisa Bonaparte?
15. Pourquoi poussa-t-elle un cri?
16. Que dit-elle à son frère?
17. Que lui proposa-t-elle de faire?
18. Que lui répondit Napoléon?
19. Qu'ajoutait-il en lui montrant la pauvre petite?
20. Quel fut l'effet des paroles de Napoléon?
21. Que fit alors Elisa?
22. Que ramassa-t-elle?
23. Y avait-il beaucoup d'œufs de cassés?

NOTES.

- (a) From appartenir.
- (b) Bouquet, clump.
- (c) So posèrent, were lowered.
- (d) Rase campagne, open country.
- (e) From gésir.
- (f) Sauvons-nous, let us run away.
- (g) From savoir.

SECTION II.

"Hélas!" disait la petite en sanglotant, "que (a) devenir? en voilà (b) au moins pour un petit écu (c) de perdus! Que dire (d) à maman quand je vais être de retour? Je vais être battue, et le produit de ces œufs qui devait faire vivre notre famille pendant trois jours!"

"Allons! calme-toi," dit Napoléon, en lui donnant deux petites pièces de monnaie qu'il avait dans sa poche; "voilà déjà une partie du prix de tes œufs; suis-nous pour le reste." Elisa s'approcha et lui dit mystérieusement à l'oreille:

"À quoi penses-tu donc, Napoléon? Nous allons être, au moins pour trois jours au pain sec et à l'eau."

"Nous avons cassé les œufs," répliqua Napoléon, "il faut les payer."

En ce moment on entendit la voix perçante de la bonne qui faisait retentir l'air des noms de Napoléon et d'Elisa.

"Nous voici! (e) nous voici!" répondirent ensemble les deux enfants.

"Ah! c'est bien heureux! depuis deux heures que je vous cherche. Quelle est donc cette petite?" ajouta la bonne en voyant la paysanne qui marchait derrière Napoléon.

"C'est nous," dit Napoléon, "qui avons cassé ses œufs en courant après les papillons; et je mène cette petite à maman pour qu'elle paie (f) le dégât que nous avons fait."

Peu d'instant après, la bonne et les deux enfants, suivis de la petite paysanne, entrèrent dans une salle où était réunie la famille Bonaparte. Madame Letitia prit la parole:

"Napoléon, Elisa, je vous avais fait cadeau d'un filet; mais vous m'avez désobéi en franchissant la haie et en courant plus loin à travers la campagne; rendez-moi vos filets, cela vous épargnera l'occasion de me désobéir encore."

"Maman," fit (g) Napoléon, "c'est moi qui suis coupable; c'est moi qui ai entraîné Elisa."

La petite fille ne dit mot, mais elle sauta au cou de son frère.

"Ma sœur," dit l'archidiacre d'Ajaccio, "péché avoué est à moitié pardonné: je demande grâce pour Napoléon."

"Oh bien! mon oncle," dit Elisa, "demandez grâce aussi pour moi, je vous en prie, car j'ai fait bien plus de mal que lui."

"Et quel si gros péché as-tu donc commis?" dit le vieillard vénérable en souriant (h); "parle franchement, et je te promets d'intercéder pour toi."

COLLOQUIAL EXERCISE.

1. Que disait la petite fille en sanglotant?
2. Que dit-elle à l'égard du produit des œufs?
3. Que lui dit Napoléon?
4. Que lui donna-t-il pour la consoler?
5. Que dit Elisa à Napoléon?
6. Que lui répondit Napoléon?
7. Qu'entendit-on en ce moment?
8. Que répondirent les enfants?
9. Que leur dit la bonne?
10. Que dit alors Napoléon?
11. Qu'ajoutait-il en parlant du dégât?
12. Où entrèrent les enfants quelques instants après?
13. Que dit Madame Letitia?
14. Qu'ajouta-t-elle à l'égard des filets?
15. Quelle réponse Napoléon fit-il à sa mère?
16. Que fit alors la petite fille?
17. Que dit l'archidiacre d'Ajaccio à la mère de Napoléon?
18. Que dit Elisa à son oncle?
19. Quelle question lui fit l'archidiacre?
20. Que dit encore le vieillard en souriant?

NOTES.

- (a) Que devenir, what will become of me?
- (b) En voilà, here are.
- (c) Petit écu, half a French crown, three francs.
- (d) Que dire, what can I say?
- (e) Nous voici, here we are.
- (f) From payer.
- (g) Fit is often, in familiar language, used for dit.
- (h) From sourire.

KEY TO EXERCISES IN LESSON IN FRENCH.

EXERCISE 170 (Vol. II, page 365).

1. Ne connaissez-vous pas cet homme? 2. Oui, Monsieur, je le connais à son grand chapeau. 3. À quoi me reconnaissez-vous? 4. Je vous reconnais à votre démarche. 5. Reconnaissez-vous mon ami à ses gestes? 6. Non, Monsieur, je le reconnais à son habit noir. 7. Le connaissez-vous bien? 8. Je le connais de vue; mais je ne lui ai jamais parlé. 9. Vous connaissez-vous en fer? 10. Non, Monsieur; je forgeron se connaît en fer. 11. À quoi connaissez-vous votre livre? 12. Je le connais à ces marques. 13. N'avez-vous pas connu votre amie à la voix? 14. Non, Madame, je l'ai connue à sa chevelure blonde. 15. Vous êtes-vous fait connaître? 16. Je ne me suis pas fait connaître. 17. Avez-vous reconnu l'amie de Mlle votre sœur à ses cheveux bouclés? 18. Je l'y ai reconnue. 19. Le marchand se connaît-il bien en drap? 20. Il s'y connaît mieux que moi. 21. S'y connaît-il mieux que le fabricant? 22. Il s'y connaît tout aussi bien que lui. 23. L'orfèvre ne se connaît-il pas aussi bien que vous en pierres précieuses? 24. Il s'y connaît mieux que moi. 25. En quoi vous connaissez-vous? 26. Je ne me connais à rien. 27. Mieux vos sœurs ne se connaissent-elles pas bien en poésie? 28. Elles ne s'y connaissent point du tout. 29. Ne connaissez-vous pas cette demoiselle à sa robe? 30. Je la connais à sa démarche gracieuse. 31. Se sont-ils fait connaître? 32. Ils se sont fait connaître par leur mérite. 33. N'est-ce pas à l'œuvre qu'on connaît l'artisan? 34. À l'œuvre on connaît l'artisan. (La Fontaine.) 35. Il s'y connaît.

EXERCISE 171 (Vol. II, page 365).

1. Are you displeased with your uncle for what he has said? 2. I am not at all displeased with him for it. 3. Would you not be thankful (obliged) to me if I took you with me? 4. I should be exceedingly obliged to you (for it). 5. Are you not thankful to them for having kept that secret? 6. I am very thankful to them for having kept it. 7. Have you not recommended them to keep silent? 8. I have (recommended them to keep so). 9. Does that patient still keep his bed? 10. He no longer keeps his bed, but he is still obliged to keep his room. 11. Is your hair well tied? 12. No, Sir; it flies at the will of the wind. 13. Will you keep your servant? 14. I will keep him, he does every thing to my fancy. 15. Whatever offers may be made to him, he will not leave me. 16. However good those ladies may be, they are not to my fancy. 17. Whatever the consequences of this affair may be, I am thankful to you for your intentions. 18. Beautiful as she is, she is not to my mind. 19. Have you done it against your wish (in spite of yourself)? 20. No, Sir; I have done it willingly. 21. Willing or not willing, he shall go away. 22. Will you keep my secret? 23. I will keep it. 24. He changes his opinion with every event.

EXERCISE 172 (Vol. II, page 365).

1. Se mariera-t-il contre le gré de son père? 2. Il ne se mariera pas contre le gré de ses parents. 3. De quoi me savez-vous mauvais gré? 4. Je ne vous sais mauvais gré de rien. 5. La chevelure de votre petite fille est-elle nouée? 6. Elle n'est pas nouée, elle flotte au gré du vent. 7. Que pensez-vous de mon livre? 8. C'est à moi gré le meilleur livre que j'aie lu. 9. Ne me saurez-vous pas mauvais gré de ne pas venir aujourd'hui? 10. Je ne vous en saurais pas mauvais gré. 11. Ne lirez-vous pas cette lettre? 12. Quelque bien écrite qu'elle soit, je ne la lirai pas. 13. Ces dames sont-elles belles? 14. Quelque belles et bonnes qu'elles soient, elles ne sont pas à mon gré. 15. Êtes-vous fâché contre mon frère? 16. Non, Monsieur; je lui suis

bon gré de ses intentions, quelles que soient les suites de sa conduite. 17. Me garderez-vous le secret? 18. Je vous le garderai de bon gré. 19. Votre sœur garde-t-elle le lit de bon gré? 20. Elle ne garde pas la chambre de bon gré. 21. Bon gré, mal gré, il faut qu'elle garde la chambre, quand elle est malade. 22. C. Jerez-vous le secret sur ce point? 23. Je le garderai de bon gré. 24. Je vous sais bon gré de vos bonnes intentions. 25. Lui savez-vous bon gré de cela? 26. Je lui en sais bon gré. 27. Le juge gardera-t-il son domestique? 28. Il le gardera. 29. Fait-il son travail à son gré? 30. Il le fait à son gré. 31. M. votre frère est-il obligé de garder la maison? 32. Il est obligé de garder le lit. 33. N'a-t-il pas quitté sa chambre? 34. Il n'a pas encore quitté sa chambre; il est trop malade pour la quitter. 35. Si vous vouliez faire cela, je vous en saurais le meilleur gré du monde.

MECHANICS. EXIII.

PRINCIPLE OF VIRTUAL VELOCITIES—THE THREE SYSTEMS OF PULLEYS.

In our last lesson we noticed the two kinds of single pulleys, the fixed and the movable. In the fixed pulley there is no gain at all in power: a force of 1 pound will only support a weight of the same amount. What, then, is the use of it? Simply that it enables us to change the direction in which any force acts—often as great an advantage as an increase of power would be.

Suppose, for instance, a man wants to raise a heavy bale to the top of a warehouse. He might go to the upper story, and lift it by pulling in a rope tied round it; but this would be a very bad way of applying his force, and would soon tire him, and, at the same time, there would be a great danger of his overbalancing himself and falling. Instead of this, the rope is passed over a pulley fixed to an arm which projects from the warehouse, and he stands within, or on the ground, and by pulling downwards raises the bale.

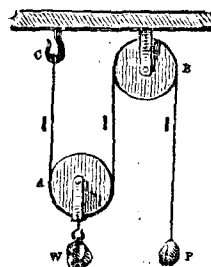


Fig. 70.

In the single movable pulley there is, as we saw, an actual gain, a power of one pound balancing a weight of two pounds. The single fixed pulley, or runner, is often used with this, not that it increases the advantage gained, but merely to change the direction, it being usually more convenient for the power to act downwards than upwards.

Now, if we turn our attention to the figure, we shall learn from it a new and very important principle, which, though it strictly belongs to dynamics,

time being taken into account, we had better inquire into now, as it will help us more clearly to understand our subject.

We have supposed that there is equilibrium in the system, that is, that the power exactly balances the weight, being, in this case, just one-half of it. Now, let the power be slightly increased so that r falls; the weight, w , will then be raised; and let this continue till it has been raised through a space of, say, two inches. Now, since it is supported by the cords, or rather the two parts A, B, C of the same cord, it is plain that each must be shortened by the same quantity—namely, two inches—and to effect this, r must move through four inches, or double the space passed over by w . Thus while, on the one hand, a power of one pound will balance a weight of two, the power must, on the other hand, be moved through four inches in order to move the weight through two, or, in other words, the power is only one-half the weight; but in order to raise the weight any given distance, it must move over twice that distance. This rule is frequently expressed as follows:—

Whatever is gained in power is lost in time; that is, if by any of the mechanical powers we are enabled to overcome a larger resistance than the power could if directly applied, in just that proportion will the space through which the power moves be larger than that through which the weight moves, and therefore the time occupied will be proportionally longer.

This simple principle applies to all the mechanical powers, and, when fully understood, clears up many difficulties, and removes apparent paradoxes. It is, therefore, important for us to be clear about it. A machine cannot create force; it merely modifies the force or motion of the power, so as to cause it best to produce the resistance or motion required. The power must be supplied by some "prime mover," as it is called, such as

the force of the wind or the tide, the strength of men or animals, or the force of heat, which converts water into steam. But when we have the force we can store it up, as is the case in a clock or watch, where the real driving power, which is the force of the hand exerted in winding it up, is laid up in the spring and used gradually; the spring not being, as it is commonly called, the moving power, but merely a kind of reservoir in which it is stored up for future use. Or we can modify and change the mode of action of our force, as in a water-mill, where the onward force of the stream is changed into the circular motion of the millstone, or applied in any other way that may be desired.

If by the movable pulley a man can lift a weight of two hundred-weight to any given height—say, for instance, four feet—when without it he can only lift one hundred-weight, it will take him twice as long to do it, and the practical result will be the same as if he divided the weight into two of one hundred-weight each, and lifted each separately; the only difference being one of convenience, for by it he can lift a weight which otherwise would be too heavy for him to move.

If we for a moment retrace our steps, and see the application of this principle to the mechanical powers we have already considered, we shall perceive more distinctly its full meaning and importance.

Let us take again the case of a lever of the first kind.

Suppose the power to act at a distance from the fulcrum, F , five times as great as the weight does; let r be, for instance, 10 feet, and r w 2 feet. Then a power of 3 pounds will balance a weight of 15 pounds. If r be now

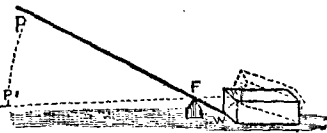


Fig. 71.

slightly increased, w will be raised—that is, a weight of 15 pounds will be lifted by a force only slightly greater than 3 pounds. This at first sight seems very strange, and a contradiction of our principle that a machine cannot create force. But let us suppose that r has moved to r' , so that the lever is now in the position of the dotted line $r'w'$, w having likewise moved to w' ; r will have passed over the arc rr' , and w over ww' ; and since r is five times as great as r' , r' is also, by the laws of geometry, five times as great as ww' . You can easily satisfy yourself of this by actual measurement. And so, though the power has lifted a weight five times as great as itself, in order to do so, it has had to pass over a space five times as large as that passed over by the weight.

We thus get another way of expressing our principle, which should be carefully remembered:—The power multiplied by the space through which it moves is equal to the weight multiplied by the space through which it moves. Of course, as before explained, when we speak of the power multiplied by the distance, we mean the product of the two numbers which represent the number of units of weight in the power, whatever they be, and the number of units of length in the distance.

In the case above let r r' be 5 inches, ww' will be 1 inch, and 3 (the number of pounds in the power), multiplied by 5 (the number of inches through which it has passed), is equal to 15 multiplied by 1. This equation, as it is called, is plainly true, each product being 15.

This principle, which is called the LAW OF VIRTUAL VELOCITIES, is the fundamental principle in mechanics, and holds good in all the mechanical powers. On account of its importance, it has been called the Golden Rule of Mechanics.

We will now trace its application to the wheel and axle, which is, in reality, only a modification of the lever, being an arrangement whereby an endless succession of levers may be brought into play, for any two radii of the wheel and axle in the same straight line may be considered as a simple lever.

If the power be slightly increased it descends, and, when the wheel has turned just once round, will have fallen through a space equal to the circumference of the wheel. In the same time, the weight will have been raised through a space equal to the circumference of the axle. But the circumference of circles always bear the same ratio to one another that their radii bear. If, then, the radius of the wheel be 12 inches, and that of the axle 3 inches, the power will pass through four times as great a space as the weight, but will only be one-fourth of it.

HISTORIC SKETCHES.—XXXVII.

THE MOSLEMS IN EUROPE.

It was a momentous issue that was decided on the last day of that seven days' battle between the Saracenic host and the army of European Christians under Charles the Hammer (so called from the way in which he smote the enemy on this occasion), which was fought on the banks of the Loire, at the spot where now stands the city of Tours, on October 10, A.D. 732.

The question at issue really was whether or not the dominion of the Saracens, who had already conquered so far and so thoroughly, should be extended to northern and western Europe, and whether Christianity should be subverted by the religion of Mahomet, whose intolerant disciples and zealous proselytisers the Arabian Saracens were. To the cries of "Death or the Koran!" "There is but one God, and Mahomet is the prophet of God!"—cries which were the knell of hundreds of thousands of Christians—the Saracens burst from their desert home in Arabia, and swept in one strong tide of conquest through northern Africa, western Asia, and eastern Europe, till they paused on the Morocco shores of the Mediterranean Sea. They looked northward; they were full of energy and restlessness, and they thought to gratify their ambition and to spread the religion of their prophet by further conquests on the continent of Europe. While in this frame of mind a renegade Christian knight, Count Julian, displeased with the treatment he had received from his master, the Gothic King of Spain, invited the strangers to invade his master's kingdom. Under the conduct of Tarik (whose name is preserved in that of the rock of Gibraltar, called by the Saracens *Gibet-al-Tarik*), a resolute band crossed the straits, landed in Spain, and, assisted by reinforcements of their countrymen, conquered the country, and reduced the Christians to a condition of dependence, if not of slavery. As soon as they had settled their new gain into something like order, they looked round for fresh conquests, and marching across the Pyrenees, pushed on as far as the Loire, overcoming the very slight resistance that was opposed to them. Their plans included the conquest of France, Italy, and Germany, the seizure and dismemberment of the Greek empire being reserved as a sort of *bonne-bouche* for the last. The effect of this would have been, in all human probability, to drive Christianity into the cold regions of the extreme north, where the remnants left of the European nations would have found a home, secure by virtue of its climate, from the attacks of the cold-dreading sons of Arabia. There seems, however, to be a rule of nature that the south shall not prevail over the north, but contrariwise, that in the long run the north shall be master. So it proved at the battle of Tours in 732. Though the accounts we have of the battle, and of the circumstances attendant upon it, are chiefly from Christian writers, whose record bears upon the face of it strong marks of exaggeration, especially in point of numbers, the Saracen host being computed at near half a million of men, we may yet gather that the contending hosts were vast, considering the populations which furnished them, and also we may believe that the Christians were in the minority. For seven days the fight lasted; scarcely was night allowed to break the continuance of the fray; the cross and the crescent struggled for the mastery, and the iron-clad warriors of the Church struck hard and thrust deep against the lighter-armed Moslems, whose skill and bravery had brought so many nationalities to their feet. May we not join with the valiant and pious men who, having fought and conquered with Charles the Hammer, ascribed the victory, not to the strength of their own arms of flesh, but to the mercy of the Lord, who fought on his people's side?

Some accounts have it that 300,000 of the Saracens were slain, an almost incredible statement when we consider the gunpowderless weapons with which all the butchery must have been done; but however that may be, the Saracens were routed with such tremendous loss that they never afterwards attempted an invasion of France. Their shattered army recrossed the mountains, and sought in the quiet of its Spanish provinces to be healed of the wounds which "so bloodily did gawn upon its face." Charlemagne, grandson of the Hammer, recovered from the Saracens a large portion even of their Spanish territory, and established a military colony in the acquired districts to serve as a bulwark to Christendom against further encroachments from the south.

But who were the Saracens, and whence came they? The

answer involves some mention of the origin of the Mahometan religion. About the year of our Lord 569 there was born at Mecca one Mahomet, the son of a Christianised Jewess and her husband Abdallah, who was an idolater. Mahomet's parents died when he was a lad, and from the age of thirteen till he was more than forty he was engaged in trade, having been instructed and brought up by his uncles, Abu-Taleb and Abd-al-Motaleb. While still a young man he married Kadijah, a rich widow, old enough to be his mother, and being by the marriage placed in affluence, gave himself to contemplation and to study. Every year he retired to a cave near Mecca in order to spend a month in solitude and prayer, and he announced that during these periods the angel Gabriel appeared to him and told him hidden things. Then he related how he had been taken by the angel into the presence of God, who had told him he was to be his prophet, that prophet which should unite all men under one religion of which the one indivisible God was head. The Koran, or "Book that ought to be read," contained the revelations which the angel Gabriel, as the mouthpiece of the Almighty, was supposed to have made to Mahomet.

The first to believe in Mahomet as the prophet of God was his wife Kadijah, whose example was followed by several of Mahomet's kinsmen and acquaintance; but the people were slow to accept him, and the authorities at Mecca were so scandalised at his professions, that after a short time spent in preaching to the people he was forced to fly to Yatrib, now Medina (the city), where he had many disciples. Medina became the nucleus of the prophet's power, and thither flocked the discontented and the converted to enrol themselves under his banner. Bands of armed men belonging to his sect infested the road to Mecca, hostilities broke out, and Mahomet succeeded, after several encounters in which fortune did not always favour him, in arranging for peace, one of the conditions of which was his public entry into Mecca in his capacity of prophet. From this time Mahomet became the most powerful prince in Arabia, converts by the thousand were made to his religion, and he began to turn his thoughts towards spreading his doctrines beyond the limits of his own country. For "the people of the book"—that is to say, people who claimed to have had special revelations, as the Jews and the Christians—he allowed his followers to have toleration on payment of tribute, but for idolaters of all kinds the message brought by Mahomet contained only a choice between the alternatives, Death or the Koran. Mahomet, beyond sending a few military missionary expeditions under enthusiastic commanders against some of the southern provinces of the Greek empire, does not appear to have done much more than to acquire for himself and his religion a complete supremacy in Arabia. All foreign rule was abolished by him, all other religious systems were forced to yield precedence to his within the borders of Arabia, and ready to do his bidding was an army of 100,000 hardy warriors, unenervated by civilisation, and entirely possessed with the belief that it was their duty and their privilege to spread the knowledge of Mahomet and his teaching.

On the 8th of June, A.D. 632, the prophet died from the effects of poison, administered, it is said, by a Jewess who wished to try whether he actually was, as he asserted himself to be, the Messiah that should come into the world. Discord sprang up among the chiefs upon the question of a successor, but the supreme command over the faithful was at length accorded to Abubeker, the father of Ayesha, Mahomet's favourite wife. Abubeker crushed by force of arms the efforts of rivals to depose him, assumed the title of Khaliph, or Vicar, and proceeded forthwith to enlarge the borders of the Saracenic empire. Making wise choice of commanders, chief of whom was the mighty Khaled, "the sword of God," he invaded Syria, Babylon, and the nearest provinces of the Greek empire; and covered the Saracen arms with the laurels of victory. Damascus and Jerusalem were both attacked, and the former, though defended by a numerous garrison, and though the Emperor Heraclius sent an army of 100,000 men to relieve it, was captured on the very day that Abubeker died (A.D. 634). Under Omar, the successor of Abubeker, Persia, Egypt, and Syria fell, Jerusalem itself falling into the Khaliph's power in the year of our Lord 637. Upon the spot where Solomon's temple had stood, the great mosque of Omar was built; the Christians were allowed to retain their churches, and were promised protection in return for tribute, and at first it seemed as if the

change of masters would prove beneficial—the change from the slothful mis-government by provincial governors appointed by the emperor, to the strong, just, and wise government of the Khaliph.

From the death of Omar, who was assassinated in 643, till the invasion of Spain in 710, the Saracen empire had extended its borders with little intermission. Besides establishing itself all along the coast of northern Africa, it had mastered the islands of Sardinia, Sicily, Rhodes, and Crete, and had effected a lodgment on the Italian peninsula. But during that time also divisions had sprung up among chiefs who each claimed the throne, and who appealed to the sword to decide between them. The Arabian simplicity and hardihood became diminished by contact with civilisation and refinement, and it was found by the middle of the eighth century that the authority of the Khaliph at Bagdad was practically set at naught, and his dominion confined to the limits of the city itself. Quasi-independent kingdoms were erected in Tunis, Tripoli, Egypt, Morocco, Damascus, and Spain, each under some successful soldier chief, who owned only a nominal allegiance, if any, to the Commander of the Faithful at Bagdad.

This decline in power, these splittings up of the unity of the empire, were the salvation for a while of the Greek empire. They were the causes, too, coupled with the establishment of the Christian kingdoms of Leon, Castile, the Asturias, and Navarre, and the continuous bearing down from the north upon the south of the large nationalities of the German and Slavonic families, why the Saracenic wave of conquest did not sweep northwards after it was first stemmed by Charles the Hammer at the battle of Tours.

There was another and more deadly cause for the break-up of the Saracenic power, at least in the East. In the wars which the Khaliphs waged from time to time upon the barbarous people who dwelt on their north-eastern frontier, there had been captured many stalwart men, of large frame and sturdy constitution, who were allowed their freedom from labour and from the other incidents of conquest on condition of entering the military service of their captors. These men were from Turkestan, Tartars of the roughest, strongest kind. They accepted the conditions, and they formed the household troops of the Khaliph about the time when the energetic brethren of their master were establishing themselves in their newly-gained Spanish possessions. From guards they soon learned to become masters, and to dispose of the succession when that came in question according to their own liking. The Kaliphate declined visibly. Al Radi, who died in 940, was the last of the real Khaliphs; after him there was no head of the empire, and the Turkish soldiers seized for themselves the provinces immediately surrounding the capital city of Bagdad. The title of Khaliph was, however, maintained by the Turks for some nominees of their own, in order to give them a sort of title to commit the acts of government they wished. In the year 1258 it was finally abolished, the slave-masters having by that time become sufficiently strong to dispense with assistance, and to hold their possessions by the help of their own swords.

Reinforced by large additions from Tartary, the Turks took some time to consolidate their power. They borrowed from the Saracens most of what was valuable in their system, they adopted their religion, and they imported from home certain hardy principles and practices which gave solidity and robustness to the state. Now and again they had to endure the attack of some unusually energetic Greek emperor, who led his armies from Constantinople for the purpose of winning back some of the lost ground that had been wrested from feeble governors. But not unfrequently they gained the advantage in this strife, and whether they did or not, they noted down the aggression as a thing to be paid back with interest some day. That day came when Constantinople fell before their assault; but that event did not happen for more than three centuries after the Turks had become a power in the world.

The separate kingdoms of Saracenic foundation remained *in statu quo* for long periods of years, excepting that the Sultan of Egypt assumed the lead among them, and, as it fell to pieces, absorbed such provinces of the Bagdad empire as the negligence or the impotence of the Turks suffered to drift away. It was with the Sultans of Egypt, most famous of whom was Saladin, that the Crusaders had to reckon when they endeavoured to recover the Holy Land. Syria had fallen to Egypt,

and the Sultans of Egypt protected it, succeeding, ere they in due time fell before the westward march of the Turks, in driving the Christians out of the whole of Palestine, and in rendering barren of results all the work of the Crusades.

In Spain the Saracenic, or, as it was called from its identity of interest and from its origin, the Moorish kingdom, long remained in spite of the strenuous efforts of the Christian princes of the north to destroy it. Not until several of the small Christian states had been rolled into one, and made one in interest, one in political purpose, one as a nation, was an impression made on the kingdom of Granada, and even then the impression was, so to speak, a slight one. From indolence, incapacity, from whatever cause, the Christian princes who strove from the year 1100 downwards, with some prospect of ultimate success, to oust the Moors, proved unequal to the task. It was reserved for Ferdinand the Catholic, whose marriage with Isabella of Castile had welded into one the Christian power in Spain, to overthrow without hope of restoration the throne of the Moslem in Cordova. Many strong towns had been gradually won, the bulwarks of the kingdom had been sapped since many years, but on the 2nd of January, 1492, the Spanish king had the satisfaction of receiving as conqueror the keys of Granada, the last stronghold of the Moors.

Forty years had not elapsed since every echo in Europe had resounded to the crash of the Greek empire as its capital fell to the Turks. Fresh influxes of men, fresh leaders, new dynasties, had come to swell the might and to develop the resources of those invaders. An irrepressible ardour burned in their hearts to burst their bounds and to achieve conquests, and the weakness and the riches of the Greek empire proved an irresistible bait. With a multitudinous army, supplied with everything for the siege of the greatest city of the world—with skill, courage, and confidence in himself—Mahomet II. pitched his camp around the fated city, and carried it at last by assault. Constantinople passed into Turkish hands, by which it has been retained ever since; and for a while it was feared that the Moslem faith which had been kept out of Europe, save Spain, would be forced upon it by the Turks. Vienna was twice besieged by the Turks, the last time in 1683; and it was but owing to victories like the naval one of Lepanto in 1571, to those in which the king and people of Hungary so frequently sacrificed themselves, and to heroic efforts like those which enabled John Sobieski, King of Poland, to rescue Vienna in 1683, that the Turkish power was kept from encroaching further westward in Europe.

LESSONS IN ALGEBRA.—XII.

MULTIPLICATION OF FRACTIONS.

141. By the definition of multiplication, to multiply by a fraction is to take a part of the multiplicand as many times as there are like parts of a unit in the multiplier.

Thus: Suppose a is to be multiplied by $\frac{3}{4}$. Here, a fourth part of a is $\frac{a}{4}$; and this taken three times is $\frac{a}{4} + \frac{a}{4} + \frac{a}{4} = \frac{3a}{4}$; and so of other cases.

142. To multiply one fraction by another.

Multiply their numerators together, and also their denominators; the products are respectively the numerator and denominator of the answer.

143. The multiplication may often be shortened, by rejecting the same factors from the numerators and denominators of the given fractions.

EXAMPLE.—Multiply $\frac{a}{r}$, $\frac{h}{a}$, and $\frac{d}{y}$ together.

Here, a being in one of the numerators, and in one of the denominators, may be omitted. The answer is then $\frac{dh}{ry}$. If a be retained, the product will be $\frac{adh}{ary}$; and this reduced to lower terms, will become $\frac{dh}{ry}$, the same answer as before.

144. To multiply a fraction and an integer together.

Rule.—Multiply the numerator of the fraction by the integer, and the product with the same denominator is the answer; or divide the denominator by the integer, and the quotient with the same numerator is the answer.

LESSONS IN BOTANY.

EXAMPLES.—(1.) Multiply $\frac{m}{y}$ by a .

Here, $\frac{m}{y} \times a = \frac{am}{y}$. For $a = \frac{a}{1}$; and $\frac{a}{1} \times \frac{m}{y} = \frac{am}{y}$. Ans.

(2.) Multiply $\frac{m}{ax}$ by a .

Here, dividing the denominator by a , we have $\frac{m}{x}$, which is the answer. Or, by the former part of the rule, multiplying the numerator by a , we have $\frac{am}{ax}$. But $\frac{am}{ax} = \frac{m}{x}$, which is the same result as before.

145. A fraction is multiplied by a quantity equal to its denominator, by cancelling the denominator.

EXAMPLE.—Multiply $\frac{a}{b}$ by b .

Here, $\frac{a}{b} \times b = a$. For $\frac{a}{b} \times b = \frac{ab}{b}$. But since the quantity b is both the numerator and denominator, it may be cancelled, and we have a for the product as before.

146. On the same principle, a fraction is multiplied into any factor in its denominator, by cancelling that factor.

EXERCISE 21.

1. Multiply $\frac{3b}{c}$ by $\frac{d}{2m}$.
2. Multiply $\frac{a+d}{y}$ by $\frac{4h}{m-2}$.
3. Multiply $\frac{(a+m) \times h}{3}$ by $\frac{4}{(a-n)}$.
4. Multiply $\frac{a+h}{3+d}$ by $\frac{4-m}{c+y}$.
5. Multiply $\frac{1}{a+3r}$ by $\frac{3}{8}$.
6. Multiply $\frac{a}{b}$, $\frac{c}{d}$, and $\frac{m}{n}$ together.
7. Multiply $\frac{2a}{m}$, $\frac{h-d}{y}$, and $\frac{1}{r-1}$ together.
8. Multiply $\frac{3+b}{n}$, $\frac{1}{h}$, and $\frac{d}{r+2}$ together.
9. Multiply $\frac{ad}{hy}$, $\frac{a-g}{d+1}$, and $\frac{3}{7}$ together.
10. Multiply $\frac{ad}{m}$, $\frac{m}{3r}$, and $\frac{ah}{2d}$ together.
11. Multiply $\frac{a+d}{y}$ by $\frac{my}{ah}$.
12. Multiply $\frac{am+d}{k}$, $\frac{h}{m}$, and $\frac{3r}{5a}$ together.
13. Multiply $\frac{3m}{a-y}$ by $(a-y)$.
14. Multiply $\frac{h+3d}{3+m}$ by $(3+m)$.
15. Multiply $\frac{a}{y}$ by y .
16. Multiply $\frac{h}{24}$ by 6.

EXERCISE 22.

1. Multiply $\frac{3}{2}$, $\frac{4x}{5}$, and $\frac{10a}{21}$ together.
2. Multiply $\frac{x}{a}$ by $\frac{a+x}{a-x}$.
3. Multiply $\frac{3x}{2}$ by $\frac{5x}{85}$.
4. What is the product of $\frac{3x+y}{2ka+32c} \times 8$.
5. Multiply $\frac{a+b}{20x+25xy}$ by $5x$.
6. Multiply $\frac{3}{x}$, $\frac{4x}{3}$, and $\frac{a}{b}$ together.
7. Multiply $\frac{abc}{3x+y}$ by $\frac{3r+y}{abcd}$.
8. Multiply $\frac{a-b}{x}$ by $\frac{y}{a-b}$.
9. What is the product of $\frac{a}{b} \times \frac{c}{d} \times \frac{3}{4} \times \frac{b}{a}$.
10. Multiply $\frac{a+b}{4}$ by $\frac{a-b}{3}$.
11. Find the product of $a \times \frac{bc}{3x} \times 6x$.

12. Find the product $\frac{24ab}{3x} \times \frac{3xy}{8a} \times \frac{3}{4}$.

13. Multiply $\frac{x^2-4a^2}{x-a}$ by $\frac{x^2-a^2}{x+2a}$.

14. Multiply $\frac{a^4}{bx-ab}$ by $\frac{x-a}{x-a}$.

15. Multiply $\frac{1+a+a^2}{1-b+b^2}$ by $\frac{1-a}{1+b}$.

16. Multiply $1 - \frac{x-y}{x+y}$ by $2 + \frac{2y}{x-y}$.

17. Multiply $\frac{6x^3-4x^2-9x+6}{6x^3+4x^2-9x+6}$ by $\frac{2x^3+2x^2+9x+6}{6x^3-4x^2+3x+2}$.

KEY TO EXERCISES IN LESSONS IN ALGEBRA.

EXERCISE 18.

- | | |
|-------------------------------|---|
| 1. $\frac{3hm-2rd-d^2}{3dh}$ | 9. $a+c+xy+\frac{ax+bx+4d}{4x}$ |
| 2. $\frac{ay-bd+md}{dy}$ | 10. $42+2a-\frac{2b}{c}$ |
| 3. $\frac{am-dy}{my}$ | 11. $y+\frac{4a+4ab-2x+2y}{2c}$ |
| 4. $\frac{a^2+b^2}{a^2-b^2}$ | 12. $2a+2x+1$ |
| 5. $\frac{ar-am-dh}{dm-dr}$ | 13. $a+\frac{b}{m}$ or $\frac{am+b}{m}$ |
| 6. -6 | 14. $3d+\frac{h+d}{m-y}$ or $\frac{3dm-3dy+h+d}{m-y}$ |
| 7. $\frac{4dx+6bcx+bdm}{bdx}$ | 15. $5xy+\frac{a+3b}{c}$ or $\frac{5cx+a+3b}{c}$ |

EXERCISE 19.

- | | |
|--------------------------|----------------------------|
| 1. $\frac{ad+dy-hr}{dr}$ | 4. $\frac{17d-9a}{12}$ |
| 2. $\frac{ay-dm+bm}{my}$ | 5. $\frac{by-dy+bm}{my}$ |
| 3. $\frac{cdb-d-b}{ab}$ | 6. $\frac{am+m-d^2+d}{dm}$ |

EXERCISE 20.

- | | | |
|--|---------------------------------------|-------------------------------|
| 1. $\frac{h}{y}-m$ or $\frac{h-my}{y}$ | 8. $a-\frac{2x+3dy}{2y}$ | 14. $\frac{a^2x-bax}{xyz}$ |
| 2. $a+\frac{bd+ch}{cd}$ | 9. $x+y-\frac{a-b}{c}$ | 15. $\frac{b-3a}{a^2b^3}$ |
| 3. $1+\frac{2b-2c}{d}$ | 10. $\frac{x^2-y^2-10x+10y}{10x+10y}$ | 16. $\frac{1}{x^2+x}$ |
| 4. $4h-2a-\frac{5d-5b}{6}$ | 11. $c-a$ | 17. $4x-\frac{a^2b-a^3}{b^2}$ |
| 5. $ac-cv-bd-by$ | 12. $\frac{y-2x}{xy}$ | 18. $\frac{4xy}{x^2-y^2}$ |
| 6. $ay+by-cx+dx$ | 13. $\frac{2y-x}{2xy}$ | 19. $\frac{2y^2}{x^2+y^2}$ |
| 7. $\frac{ad+ay-bc+cx}{bd+by-dx-xy}$ | | |

LESSONS IN BOTANY.—XXXIV

SECTION XCVIII.—MAGNOLIACEÆ, OR MAGNOLIADS.

Characteristics: Sepals three, rarely two, or four, or six; petals hypogynous at the base of an elongated receptacle, six or more in number, and free; stamens indefinite; ovaries numerous, either free or partially coherent; bi- or pluri-ovulate; ovules pendent, reflexed; fruit various in character; carpels pedicelled, free, or coherent into a spike; dehiscent or indehiscent, dry or fleshy; seeds having an elongated funiculus; embryo very small at the base of a fleshy albumen.

The Magnolias are beautiful trees of South America and tropical Asia, possessing large, often persistent leaves, and magnificent flowers. The *Magnolia glauca* is a rustic shrub about twenty feet high, having leaves yellow beneath, and very odorous white flowers. The *Magnolia Thompsoniana* (Fig. 257), a variety of the preceding, is a fine pyramidal tree of about the same height, and differing from the *Magnolia glauca* in the circumstance of possessing larger leaves, and flowers five inches in diameter.

SECTION XCIX.—DILLENIACEÆ, OR DILLENIADS.

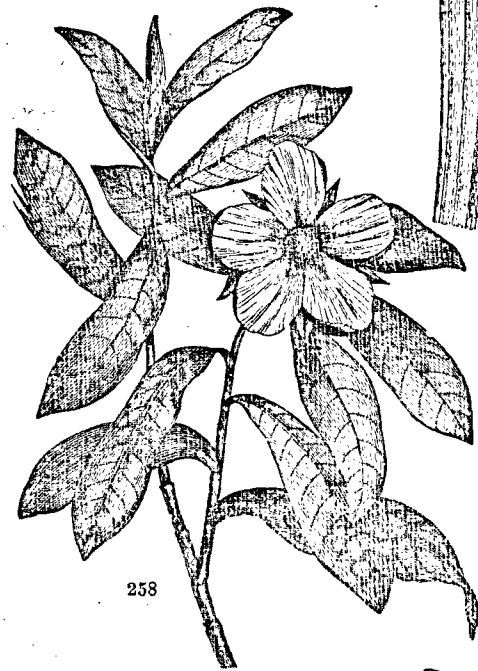
Characteristics: Sepals free, five; petals free, five, hypogynous; stamens indefinite; ovaries several, free, or nearly free;

ovules one or many, ascendant and erect, reflexed; capsules follicular or bacciform, free or coherent, seed dicotyledonous, small, at the base of a fleshy albumen, with a pulpy aril.

The *Dilleniaceæ* are allied to the *Magnoliaceæ*, from which they are separated by the characteristics of the number and lateral position of their stamens, the quinary division of their floral envelopes, always uni-serial, and their astringent properties. They differ from the *Ranunculaceæ* in their general aspect, their often unilateral stamens, their seed, arillus, and their astringent qualities. They are for the most part inhabitants of Asia and America, south of the equator. The bark of many species is employed by tanners. The fruit of many species is sour. The *Hibbertia volubilis* (Fig. 258) is an evergreen climbing shrub, indigenous to Australia.

SECTION C.—CABOMBACEÆ, OR WATERSHIELDS.

Characteristics: Sepals three or four,



257. THOMPSON'S MAGNOIA (MAGNOLIA THOMPSONIANA). 258. TWINING HIBBERTIA (HIBBERTIA VOLUBILIS).

petaloid; petals hypogynous, equal in number to the sepals; imbricated in aestivation, persistent; stamens double or multiple the number of the petals; carpels two or more, free; two or three superior ovules, pendent, reflexed; fruit indehiscent; stem floating; lower leaves, opposite, submerged, with capillary segments; the upper leaves alternate, and floating, orbicular or peltate in form. There are only two plants in this family, the *Cabomba aquatica* and *Hydropeltis purpurea*, the latter of which is a pretty plant for a large aquarium.

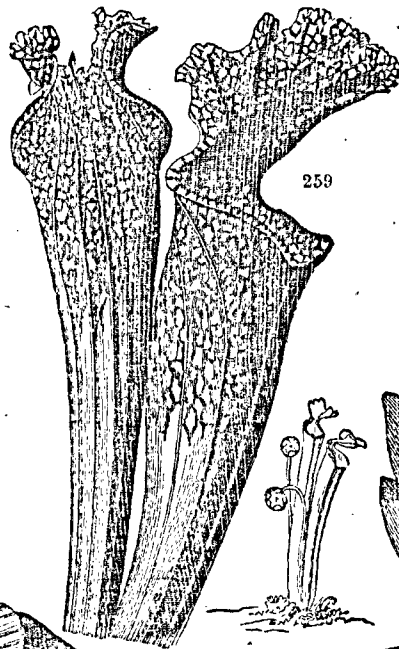
SECTION CI.—DROSERACEÆ, OR SUNDEWS.

Characteristics: Sepals five, free, or almost free; petals hypogynous, five, alternate with the sepals; imbricated

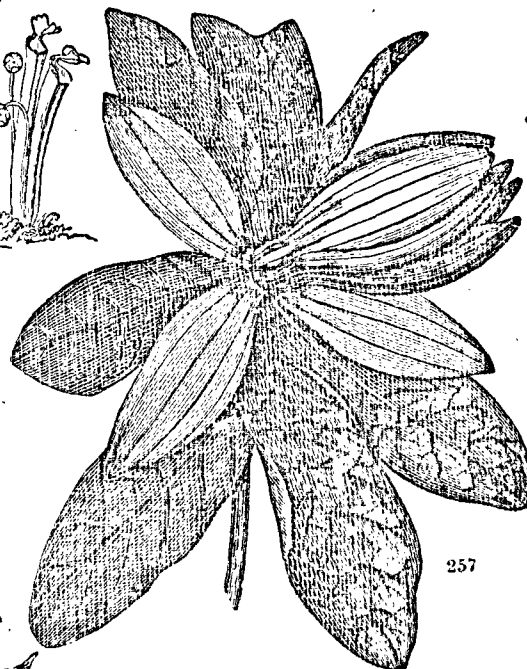
in aestivation; stamens equal in number to the petals, or some multiple of that number; anthers extrorse; ovary free; placentæ parietal, three or ten; ovules⁴ reflexed; styles free; stigmas capitate; capsule loculicidal with seminiferous valves; albumen fleshy; stem herbaceous, occasionally sub-ligneous; leaves alternate or radical, ciliated and without stipules; flowers solitary or in one-sided racemes.

The principal genus belonging to this natural order is *Drosera*, all the species of which are acrid, bitter, vesicating, and generally dangerous.

The *Dionæa muscipula*, or Venus's Fly-trap (Fig. 261), is a biennial plant of Carolina, the excitability of which is fatal to flies and other insects. Its leaves are each terminated by two rounded plates fringed with sharp spikes. Between these two plates is a hinge on which they turn, closing together like the two sides of a book-cover. On the upper face of each leaf there are three hairs,



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259. DRUMMOND'S SIDE-SADDLE FLOWER (SARRACENIA DRUMMONDII). 260. RHUBARB (RHEUM RHAPONTICUM).

which secrete a saccharine liquor. This attracts flies and other insects, which, however, no sooner touch the leaf, than the two sides, turning on their common hinge, close upon the insect, which is thus caught in a trap.

SECTION CII.—SARRACENIACEÆ, OR SARRACENIADS.

Characteristics: Sepals three to six; petals hypogynous, equal in number to the sepals, alternate with them, and unguiculated, or absent; stamens indefinite; ovary three to five-celled, pluri-ovulate; ovules reflexed; capsule loculicidal; embryo dicotyledonous, very small, lying at the base of a fleshy albumen; aquatic herbs, perennials; leaves radical and petiolated, petiole tubular or cornet-shaped; limb small, ordinarily inflected upon the orifice of the petiole. This North American



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family is composed of two genera, now well known in European gardens. The *Sarracenia purpurea* has cornet-shaped leaves, sinuous and ventricose, tinged red along the course of the veins, and on the margins; flowers red, purple without, and green within. The *Sarracenia Drummondii* (Fig. 259) bears purple flowers, has very elegant grotesque cornets, and its height is about two feet.

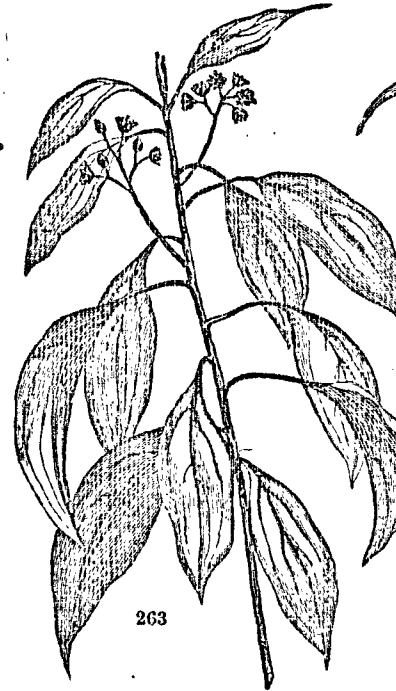
SECTION CIII.—CARYOPHYLLACEÆ, OR CLOVEWORTS.

Characteristics: Sepals five or four, free or coherent; petals five or four, hypogynous or sub-perigynous, frequently joined together and with the base of the stamens; stamens double in number to the petals, and arranged in two series, the interior ones opposite to the petals; sometimes equal to them in number; pistil on a stalk, two or three carpelled, coherent into one single ovary;

ophyllaceæ are very general favourites on account of their floral beauty and their sweet odour. A representation of two favourite varieties of the sweet-william (*Dianthus barbatus*) is subjoined (Fig. 262).

SECTION CIV.—POLYGONACEÆ, OR BUCKWHEATS.

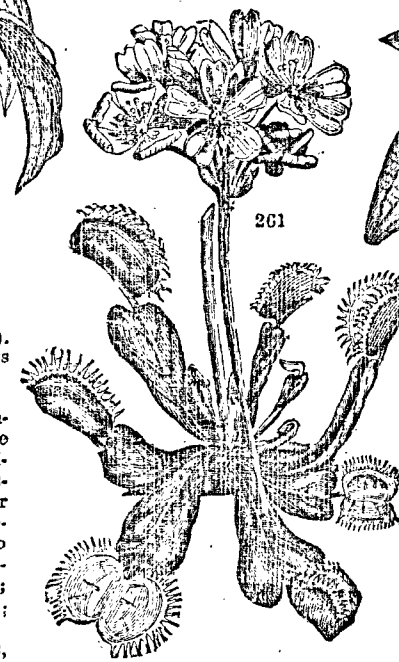
Characteristics: Perianth herbaceous or petaloid; sepals three, four, or six, coherent to a variable extent; stamens perigynous or hypogynous, four to ten; ovary unilocular, uni-ovulate, triangular or compressed; ovule, erect, straight; styles two or three; fruit, an achæmium or caryopsis; seed dicotyledonous, inverted; embryo straight or curved, embedded in a farinaceous albumen; stem ordinarily herbaceous; leaves alternate, stipulate, the stipules forming an ochrea which envelopes the stem; flowers minute, arranged in cymes, spikes, or corymbs.



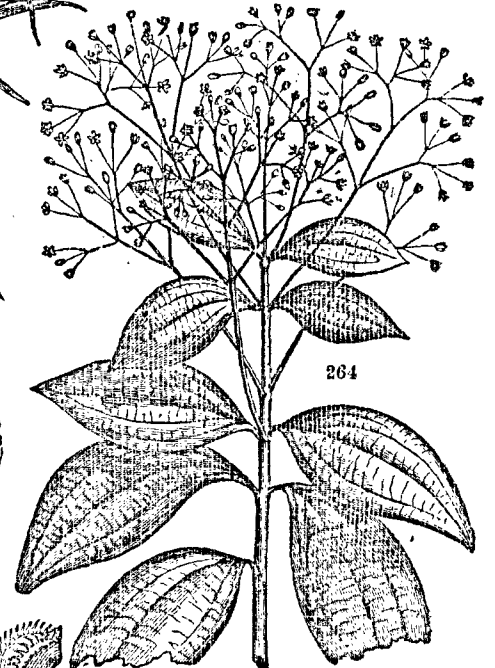
261. VENUS'S FLY-TRAP (DIONÆA MUSCIPULA). 262. THE SWEET-WILLIAM (DIANTHUS BARBATUS).



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263. THE CAMPHOR TREE (CANTHORA OFFICINALIS). 264. THE CINNAMON TREE (CINNAMOMUM DULCE).

styles free, stigmatiferous on their internal side; ovary pluri-locular in the young plant, ordinarily becoming unilocular by the absorption of commissures; ovules curved; fruit capsular and dehiscent, or bacciform and indehiscent; seed dicotyledonous; embryo curved, surrounding a farinaceous albumen; stem herbaceous or sub-ligneous; leaves opposite, entire, rarely stipuled; inflorescence definite.

The *Caryophyllaceæ* are cosmopolites, but inhabit for the most part the extra-tropical regions of the northern hemisphere. The soapwort, or *Saponaria officinalis*, is a plant indigenous to England, the root of which contains a soapy matter, lathering with water almost like soap, a soft resin, and gum. The carnations which belong to the natural order *Cary-*

virtue of which they possess medical qualities. In the first rank amongst the medicinal *Polygonaceæ* is rhubarb, celebrated from times of remote antiquity as a medicine. Rhubarb owes its valuable properties to the presence of a substance denominated by chemists *rhubarbaine*, a fixed oil, a little gum,

The members of this natural family have a similarity of chemical and physiological properties, which confirms the propriety of botanical classifications. The herbaceous portions of many species contain oxalic, citric, and malic acids, and are for the most part both medicinal and alimentary. The farinaceous seeds of many species serve as good substitutes for the cereals. The roots of many species contain astringent matters, united sometimes to a resinous and bitter principle, in

starch, and oxalate of lime; the latter material constituting one-third of its entire weight. The botanical origin of rhubarb is still enveloped in great obscurity. The Arabs received it in the tenth century from the Chinese, and made it known in Europe; but the Chinese indicated with considerable vagueness the locality of the plant, and altogether refused to supply any of its seeds or cuttings, even though an equal weight of gold was frequently offered as a premium. Three sorts of medicinal rhubarb are known in commerce; that of China, which comes to us from Thibet and Canton; that which comes to us through Russia (commonly known as Turkey rhubarb); and the rhubarb of Persia. Of the various species which have been brought to Europe and planted in our gardens, the *Rheum palmatum* is the only one which yields a result at all like that of the Oriental rhubarb; but it is still distinguishable from the latter. The *Rheum australe*, procured originally from the mountains of Thibet, and cultivated in Calcutta, still more closely resembles the Chinese rhubarb; probably, therefore, the medicinal root is obtained from this species, though the subject is enveloped in much doubt.

The *Rheum Rhaponticum*, another species of rhubarb, grows spontaneously in Thrace and on the shores of the Black Sea. This is the species which was known to the ancient Greek and Roman physicians, who gave to it the name of *Rha*. Subsequently this name was expanded into *Rha-ponticum*, for the purpose of distinguishing the vegetable from another *Rha*, the produce of Scythia, and designated *Rha-barbarum*, whence our modern word *rhubarb*. A representation of the *Rheum Rhaponticum* is annexed (Fig. 260).

SECTION CV.—LAURACEÆ, OR LAURELS.

Characteristics: Calyx four to six partite, bi-serial, trinnerved, imbricate; stamens perigynous, inserted upon a fleshy disc, springing from the base of the perianth, and persistent, in number double, or triple, or quadruple that of the sepals, sometimes equal and then opposite to the sepals; filaments free, the internal ones provided with two lateral glands; anthers adnate, bi-locular, or quadri-locular, sometimes all introrse; sometimes the interior ones introrse, the others extrorse; carpels, three united into one; ovary unilocular; ovule single, pendent, reflexed; style simple; stigma trilobed; fruit bacciform, protected by the base of the perianth; seed dicotyledonous, straight, exalbuminous; stem ligneous; bark aromatic; leaves alternate, aromatic; flowers axillary, or in a cyme, panicle, or umbel.

The bay tree (*Laurus nobilis*), indigenous to Central Europe, is a tree or shrub, with persistent leaves, coriaceous, smooth, and possessing an agreeable odour. The sassafras (*Laurus Sassafras*) is a native of Virginia, Florida, and Brazil. Every part of this tree is endowed with a peculiar odour, something like a combination of fennel and camphor. The wood of this tree is employed in medicine. The *Cinnamomum dulce* (Fig. 264), or true cinnamon, furnishes the aromatic bark known by the name of *cinnamon*. It is cultivated in Ceylon and other inter-tropical countries. The *Cassia* (*Cinnamomum Cassia*) is a native of Cochinchina, Malabar, and some parts of China Proper. Its bark is thicker than that of the true cinnamon tree, and its colour deeper. Camphor is another valuable production from one of the laurel tribe, the *Camphora officinalis* (Fig. 263), a native of Japan. The substance known as camphor, however, is not found in this vegetable only. In small quantities it exists in many plants of the natural order *Labiata*.

LESSONS IN GERMAN.—XLIV.

SECTION XCII.—IDIOMATIC PHRASES (continued).

Gehen and gehen (in the sense "to succeed or get on") are often used impersonally like the English "go;" as:—Wie geht es? how goes it? Es geht recht munter zu, they are making very merry.

1. Erst (first) often answers to the English "only, not before, no more than, just," etc.; as:—Es sieht noch so neu aus, als wenn es erst gekauft wäre, it still looks as new as though it had just been bought. Die Schule geht erst um zehn Uhr an, the school does not begin before ten o'clock. Sie ist erst dreizehn Jahre alt, she is only thirteen years old.

2. Nächst (next), applied to time, denotes the period nearest at hand; künftig (future, next, coming) applies to future time, near

or distant; as:—Ich hoffe, in der nächsten Woche dieses Buch beenden zu können, I hope to be able by (in the) next week to finish this book. Er wird in fünfzig Jahren vorzüglicher sein, in coming years he will be more careful.

VOCABULARY.

Befolgen, to manage, attend to, take care of.	Himmlich, heavenly, celestial.	Lebensmittel, pl. provisions, victuals.
Erst. (See R. 1, above.)	hinlänglich, enough, sufficiently.	Unüberlegt, inconsiderate, rash.
Gelingen, to succeed, prosper, speed.	Sin'feger (rich), to sit down.	Verforgen, to provide.
Geschäftig, busy, busied, active.	Irlich, terrestrial, earthly.	Verloren, past, gone.
Häuslich, domestic.	Künftig. (See R. 2, above.)	Zeitlich, temporal, earthly, timely.
		Zugehen. (See above.)

RÉSUMÉ OF EXAMPLES.

So geht es in der Welt zu.	So the world goes.
Es geht seit vierzehn Tagen besser mit ihm.	For a fortnight past it goes better with him.
Erst über's Jahr kann es geschehen.	It can only take place a year hence.

Sie ist erst gestern angekommen.	She arrived only yesterday.
Niemand weiß, was der nächste Tag mit sich bringt.	No one knows what the (next day) morrow may bring with it.

Niemand weiß, was die nächsten Tage mit sich bringen.	No one knows what the next days may bring with them.
In dem künftigen Jahre besuche ich wahrscheinlich die Schweiz.	(In) the coming year I shall probably visit Switzerland.

Dies war die nächste Ursache seiner Abreise.	This was the immediate (nearest) cause of his departure.
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Er hat den Auftrag befohlen.	He has attended to (done) the commission.
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Er besorgt seine Geschäfte selbst.	He attends to (does) his business himself.
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Man versorgte den Fremden mit allem, was er nötig hatte.	The stranger was provided (supplied) with all that he needed.
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EXERCISE 178.

1. Erst nahm er Papier und Feder, dann setzte er sich hin, um zu schreiben.
2. Er hat eben erst angefangen zu arbeiten.
3. Es ist erst sieben Uhr vorbei.
4. Dieser Knabe ist erst dreizehn Jahre alt.
5. Nun ging es erst recht arg zu.
6. Es ist eine halbe Stunde weit bis zum nächsten Dorfe.
7. Dies ist der nächste Weg dahin.
8. Ich will ihm mit der nächsten Post schreiben.
9. Ein unüberlegtes Wort ist zuweilen die nächste Ursache zu Streit und Hader.
10. Mein Freund kommt die nächste Woche hierher.
11. Im künftigen Jahre geht er nach Amerika zu reisen.
12. In fünfzig Jahren werde ich vorzüglicher sein.
13. Künftige Woche gehe ich einige Tage auf's Land.
14. An das künftige Leben sollten wir mehr denken, als an das zeitliche.
15. Mein künftiges Leben soll mir gemüthlich sein.
16. Ich befürchte, es wird auf diese Weise nicht gelingen.
17. Er sorgt mehr für irdische, als für himmlische Reichthümer.
18. Die geschäftige Frau besorgt alle häuslichen Arbeiten selbst.
19. Der Nachbar besorgte mit dem Brief auf die Post.
20. Der Auftrag wurde von dem kleinen Knaben pünktlich besorgt.
21. Die Forderung wurde hinlänglich mit Lebensmitteln versorgt.
22. Der Bruder versorgte mich zeitig mit guten Büchern.
23. Der arme Mann hat sechs Kinder zu versorgen.

EXERCISE 179.

1. First I shall read, then I shall write.
2. I returned from my journey only yesterday.
3. I shall not see him till tomorrow.
4. I have received only half of my books.
5. We ought first to avoid doing evil, and then to do good.
6. Next spring I shall probably go into the country for a few days.
7. Are you sufficiently acquainted with the circumstances of his immediate departure?
8. That errand was punctually performed by this man.
9. This poor woman has five children to provide for.
10. I sometimes provide him with an instructive book.
11. Next time I shall be more careful.

SECTION XCIII.—IDIOMATIC PHRASES (continued).

Ginholen (from ein, in, and holen, to fetch) signifies "to go to meet, to overtake, to outrun," etc.; as:—Eine Deputation holte den Grafen ein, a deputation went out to meet the ambassador. Nach drei Tagen hatte unsere Fregatte das feindliche Schiff eingeholt, after three days our frigate had overtaken the hostile ship.

1. Heute, to-day (Latin, *hodie*), is sometimes best rendered "at the present, now," etc.; as:—Heute zu Tage, or heutiges Tages,

at the present day, now-a-days. Unsere Sitten werden der Nachwelt einst eben so erscheinen, wie uns heute zu Tage die unsrer Vorfahren, our customs one day will appear to posterity just as (do) those of our ancestors to us at the present day. Die Geltir trübt heutiges Tages viele Tausende nach Californien, the immoderate desire for gold drives, at the present day, many thousands to California.

VOCABULARY.

Abstellen, to turn off, derive.	Ginholen. (See above.)	Packen, to pack, pack up.
Alarich, m. Alaric.	Erlernung, f. learning, acquisition.	Richtplatz, m. place of execution.
Angst, f. anxiety.	Gefallen sein, to be inclined, to incline.	Strömung, f. streaming, current, flood.
Begraben, to inter, bury.	Geth, m. Goth.	Verreisen, to go on a journey, travel, set out.
Begriff, m. conception, notion (im Begriff sein, to be on the point).	Annig, heartfelt, hearty.	Zuvor, before.
Bufen's, m. Busento (river in Italy).	Leiten, to guide, lead, conduct.	

RÉSUMÉ OF EXAMPLES.

Er wünschte mir eine angenehme Reise.	He wished me a pleasant journey.
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Ich gedenke frühere Zeiten, und gedachte Ihrer oft während meiner Krankheit.	I remember former times, and thought of you often during my sickness.
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Ich gedenke seinen Fleiß zu belohnen.	I intend to reward his diligence.
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Er gedachte mir ein Leid zu thun.	He designed to do me an injury.
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Ich bin nicht gesonnen dazwischen zu willigen.	I do not intend to agree to it.
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Ich packe meinen Koffer, weil ich gehen will.	I am packing my trunk, because I intend in a few days to go on a journey.
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Er ist im Begriff, nach Asien zu reisen.	He is on the point of going to Asia.
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Gustav Adolph führte seine Schweden von Siez zu Siez, und erkaufte den bei Lützen mit seinem Leben.	Gustavus Adolphus led his troops (Swedes) from victory to victory, and purchased the one at Lützen with his life.
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Der Blitzableiter ist eine wichtige amerikanische Erfindung.	The lightning-rod is an important American invention.
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EXERCISE 180.

1. Ich wünsche Ihnen einen guten Morgen.
2. Ich habe die Ehre, Ihnen einen guten Morgen zu wünschen.
3. Ich gedenke (Sect. XLVI.) meiner Freunde mit inniger Liebe.
4. In den Zeiten des Glückes gedachte er seiner nicht, wohl aber in den Stunden der Angst und Noth.
5. Ich gedenke zu verreisen.
6. Ich gedenke bald wieder zu kommen.
7. Wir gedenken zu verreisen.
8. Ihr gedachtet es böse mit mir zu machen.
9. Der Vater ist gekommen, dazwischen zu willigen.
10. Ich war nicht gesonnen, dahin zu gehen.
11. Ich packe meinen Koffer, weil ich gehen will.
12. Ich stehe im Begriffe, abzureisen.
13. Ich bin im Begriffe, aufzubrechen.
14. Man führt den Verkehrer zum Richtplatz.
15. Der Sohn des Herzogs führte die Truppen selbst zum Sturm.
16. Er führte sie zum Angriff.
17. Rußland führte Krieg mit Polen.
18. Der Kaufmann führt Waaren zum Markt.
19. Ein kleines Kind leitete den blinden Mann.
20. Alarich wurde von den Gothen in dem Busento begraben, nachdem sie zuvor die Strömung abgelenkt hatten.
21. Er leitete einen Jelen nach seinem Rath.
22. Wer sich nicht von der Vernunft leiten läßt, der läuft Gefahr, daß ihn seine Leidenschaften in's Verderben führen.
23. Der fleißige Schüler holte seine Kameraden bei der Erlernung der englischen Sprache nach ein, obgleich dieselben keine so viel Wochen eher angefangen hatten.
24. Wir holten die Freunde auf ihrem Wege nach ein, obgleich sie eine halbe Stunde früher fortgegangen waren.
25. Heute zu Tage erreichen die Menschen ein so hohes Alter mehr, als in früheren Zeiten.
26. Man hört heute zu Tage von nichts Anderem sprechen, als von Krieg.
27. Man hört heutiges Tages viel Klagen über schlechte Zeiten.

EXERCISE 181.

1. I wish you a good evening.
2. I have the pleasure to wish you a good morning.
3. When in foreign countries, we often remember with affection our friends at home.
4. I intend to go next month to the Continent.
5. Do you intend to remain long there?
6. No, I do not intend to remain long there; I shall soon return.
7. He tried to overtake his friend in learning the German language, but he could not, as his friend was too far advanced.
8. Do you intend to overtake your brother on his

journey? 9. I overtook my brother after three days' journey. 10. Six months ago I was on the point of going to America, but now I am very glad that I remained at home.

SECTION XCIV.—IDIOMATIC PHRASES (continued).

Hören (to hear), followed by auf, with an accusative, signifies "to listen to;" as:—Er hört auf das, was ich ihm sage, he listens to what I tell him.

Hören, however, when connected with auf as a mere prefix, signifies "to cease, to discontinue;" as:—Es hört auf zu regnen, it stops raining (ceases to rain). Der Regen hört auf, the rain ceases.

1. Aber, in the phrase *Sunterte und aber Sunterte*, Tausende und aber Tausende, etc., signifies "yet again, yet more, still other." So, also, O weh und aber weh dem Mann, O woe and yet again woe to the man.

2. Zu Grunde gehen, "to go to the ground, or to the bottom, that is, to sink, to founder," has hence the general signification, "to go to ruin, or be destroyed." So, also, zu Grunde richten, "to destroy, to ruin," etc.; as:—Das Schiff ist mit Mann und Maus zu Grunde gegangen, the ship with man and mouse has perished (gone to the bottom). Unvorsichtige Speculationen haben den Kaufmann zu Grunde gerichtet, imprudent speculations have effected the ruin of the merchant.

VOCABULARY.

Abendbrot, n. supper.	hafen, m. harbour, port.	Schande, f. shame, disgrace, infamy.
Aufhören. (See above.)	lächeln, to smile.	Segel, n. sail.
Brosau, n. Breslau.	landen, to land, come to shore.	La'geschaft, n. business of the day.
Dulden, to bear, suffer, tolerate.	Sinte, f. linden-tree.	Ufer, n. bank, shore.
Er'sen, to slay, kill.	Mittagsmahl, n. dinner.	Verri'ten, to do, perform.
Kaufrecht, n. club-law, sword-law.	Osten, m. East.	
Gebrauch, m. usage, custom, fashion.	Rath, counsel; tagu fann Rath werden, that may be done, or it may happen.	Verfchwen'derisch, prodigal, lavish, profuse.
Gerichten, to redound, turn to, conduce.	Reich, n. empire, kingdom, realm.	Verfin'en, to sink, lose courage.
Grab, n. grave.	Reichsburg, n. Ratisbon.	Verjagen, to faint, lose courage.
Habsburg, n. Hapsburg (original house of the imperial family of Austria).	Reichstag, m. imperial diet, diet.	Zwistigkeit, f. discord, dissension, quarrel.

RÉSUMÉ OF EXAMPLES.

Setzt auf, des Lebens Teppich vor mich auszubreiten, ich bin elend und gefangen (Schiller).	Cease to spread life's carpet out before me; I am miserable and imprisoned.
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Sobald er dieses sah, hörte er auf zu spielen.	As soon as he saw this, he ceased to play (stopped playing).
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Liebig gehört zu den gelehrtesten Männern Deutschlands.	Liebig belongs to (is among) the most learned men of Germany.
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Er ging nicht eher aus, als bis er eine Stunde gelesen hatte.	He did not go out before (till) he had read an hour.
---	--

Der russische Feldzug richtete die "Grande Armée" (wie man sie zu nennen pflegte) zu Grunde.	The Russian campaign ruined (destroyed) the "Grand Army" (as it used to be called).
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Bei dem russischen Feldzuge ging die "Grande Armée" zu Grunde.	In the Russian campaign the "Grand Army" was destroyed.
--	---

Tausende und aber Tausende kamen um ihr Leben.	Thousands upon thousands lost their lives.
--	--

Als ich ankam, las er eben meinen Brief.	As I arrived he was just reading my letter.
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Das gereicht ihm zur großen Ehre.	That redounds greatly to his honour.
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EXERCISE 182.

1. Als Rudolph von Habsburg Kaiser von Deutschland geworden war, hörten die innern Zwistigkeiten und das sogenannte Kaiserrecht in diesem Reiche auf.
2. Nachdem sie einige Girsche erlegt hatten, hörten sie auf zu jagen.
3. Es hört auf zu regnen, und wir können nun unsere Reise weiter fortsetzen.
4. Mein Bruder ist zu Hause, er liegt schon acht Tage zu Bette.
5. In Deutschland sind andere Sitten und Gebräuche, als in Amerika.
6. Zu Regensburg wurden in der letzten Zeit die Reichstage gehalten.
7. Die hohe Schule zu Breslau gehört zu den besten in Deutsch-

land. 8. Als wir hinkamen, freisten sie gerade zu Mittag. 9. Sie pflügten nicht eher die Ackerfelder zu offen, als bis sie alle Tagelöhner verrichtet hatten. 10. Unter einer alten Linde, welche in dem Hofe stand, hielten sie im Sommer, bei schönem Wetter, ihr Mittagmahl. 11. Als die Chelera in Paris herrschte, starben Tausende und aber Tausende an derselben. 12. Die Soldaten zogen zu Felde. 13. Bei dem letzten Sturm sind mehrere Schiffe zu Grunde gegangen. 14. Der Bettler geht von Thür zu Thür, und von Dorf zu Dorf. 15. Das gerichtete mir zur Ehre, ihm zur Schande. 16. Mir zu Gefallen künnten Sie es thun. 17. Der Feind steuert mit allen Segeln nach Osten zu. 18. Das ist für ihn zu gut. 19. Ich bin nur zu gewiss, daß es so kommen wird. 20. Es kann auch dazu Rath werden, wenn wir erst unsere eigenen Angelegenheiten geordnet haben werden. 21. Das Leben ist, Freund, ein ernstes Geschäft, —bist du kein Ungenue; so nur wird dir die Reise sanft. 22. Endlich landest du doch sicher am Ufer, in deinem Hafen; er heißt das Grab. 23. Er hat sich und seine Freunde zu Grunde gerichtet. 24. Er hat bei tiefen Arbeiten seine Gesundheit zu Grunde gerichtet. 25. Nelson richtete die französische Flotte zu Grunde. 26. Wenn er nicht vorsichtig ist, so kann in kurzer Zeit sein ganzes Geschäft zu Grunde gehen.

EXERCISE 183.

1. Are you listening to what I tell you? 2. Yes, I am listening to what you say. 3. Do you think that he will listen willingly to that proposal? 4. If you listen to what the teacher tells you, you will acquire knowledge. 5. Can we remain with you until the storm has ceased? 6. As soon as the rain ceases, we shall continue our journey. 7. As soon as we saw our teacher, we stopped playing and began to write. 8. Hundreds upon hundreds lost their lives by the revolution in France. 9. After his imprudent speculation had ruined him, he became more careful. 10. It redounds to the honour of a king, to govern his dominion in peace. 11. Do not despair when fortune does not smile on thee, or even when thou art sunk in the deepest misery; for it may happen, ere thou thinkest it, that thou mayest be providentially disburdened of all thy troubles.

KEY TO EXERCISES TO LESSONS IN GERMAN.

EXERCISE 184 (Vol. II., page 405).

1. Excuse me, sir; it was not done intentionally. 2. If he did it intentionally, he is by no means to be excused. 3. Although you did not do it purposely, still it is culpable. 4. Had you done it purposely, then you ought to be ashamed of yourself. 5. They have liberated the prisoner on purpose. 6. This man has not intentionally brought on this delay. 7. As long as such men are at the head of the State we cannot expect an improvement. 8. As long as I have no employment, I cannot be contented. 9. As long as you are well-behaved, you shall have everything that you require. 10. As long as the world has stood, no one has made such an assertion. 11. I will work for you as long as you are ill. 12. As long as he was absent we took care of his whole family. 13. You can lodge in my house as long as you like. 14. If he does not stay so long, he cannot receive my letters any longer. 15. This man works from day-break till late at night. 16. From this time forth I shall take a walk every day from the river to the mountain. 17. I have now received a letter, and shall go to my friends as soon as I can. 18. I shall have arranged all my affairs till the twentieth of January. 19. As I have now arrived, I shall speak to him as soon as I see him. 20. When they came at last, it had become night. 21. From this time forth we shall be friends. 22. We intend to remain in town till it grows evening. 23. The merchant put everything on one account. 24. What you have done is now placed to my account, and I must suffer for the wrong which you have committed. 25. The heat is suffocating to-day. 26. The unfortunate man was suffocated by the smoke. 27. The weeds choke the tender plants. 28. The town was given up to be plundered by the infuriated soldiers. 29. He was left to his fate. 30. He gave especial importance to his gallant behaviour, and publicly praised him. 31. In his embarrassment he could not utter a word. 32. She produced an old book after a long search.

EXERCISE 185 (Vol. II., page 405).

1. Die Bücher, welche ich bei Ihnen gekauft habe, Ihnen Sie auf meine Rechnung setzen. 2. Die Sieger machten sich auf Rechnung ihrer Feinde lustig. 3. So lange der Mensch Beschäftigung hat, kann er zufrieden sein. 4. So lange die Welt steht, wird Gottes Wort nicht untergehen. 5. Ich werde für meinen Freund arbeiten so lange er krank ist. 6. So lange die Schüler fleißig sind, wird der Lehrer sie loben. 7. Sie können bei meiner Familie bleiben so lange Sie wollen. 8. Wenn Sie bleiben wollen, bis ich diese Briefe fertig habe, so können Sie dieselben meinem Freunde mitnehmen. 9. Wenn nun an werden wir mehr Zeit auf das Studiren verwenden. 10. Das Schiff war dem Winte und den Wellen Preis gegeben. 11. Von Tagesanbruch bis spät in die Nacht war die Stadt dem Feuer des Feindes ausgesetzt. 12. Die Sonne bricht zwischen den Wolken hervor.

13. Die Athener erklärten, Niemand als Jupiter sollte von nun an in Athen regieren. 14. So lange mein Innerstes mein Betragen billigt, wird (soll) das Urtheil der Leute mich nicht beunruhigen. 15. Er hat den letzten Punkt seiner Rede besonders hervorgehoben. 16. Sie machten sich auf seine Rechnung lustig, und er nahm es nicht wahr.

EXERCISE 186 (Vol. II., page 406).

1. The teacher loves and praises the diligent scholar. = The diligent scholar is loved and praised by the teacher. 2. The huntsman shoots, not only wolves and bears, but also birds. = Not only wolves and bears, but also birds, are shot by the huntsman. 3. The mother warned the son. = The son was warned by the mother. 4. The letter-carrier brought a letter. = The letter was brought by the letter-carrier. 5. The Jew has bought the poor man's horse. = The poor man's horse has been bought by the Jew. 6. The Swiss has sung the songs of the Alps beautifully. = The songs of the Alps have been beautifully sung by the Swiss. 7. The child has forgotten the book. = The book has been forgotten by the child. 8. The butcher has killed the calf. = The calf has been killed by the butcher. 9. The commander-in-chief will praise his soldiers. = The soldiers will be praised by their commander-in-chief. 10. God will reward the good. = The good will be rewarded by God. 11. The neighbour will have assisted the friend. = The friend will have been assisted by the neighbour. 12. The heathen priest will have sacrificed the poor girl. = The poor girl will have been sacrificed by the heathen priest. 13. Caesar was murdered with the co-operation of his friend Brutus. 14. The steepest rocks are climbed by the chamois-hunters. 15. The favourable moment is seized by the prudent man. 16. There was more done in half an hour than at other times in an hour. 17. The quarrel was carried on with great animosity on both sides. 18. Already many a valuable hour has been mis-spent (literally, unused). 19. The work is finished at last, and will appear in a few days. 20. At last it has been ascertained who is the thief. 21. The bridge was carried away by the ice. 22. The camels are often killed by the travellers in the desert, in order to obtain water. 23. The sons of Brutus had been condemned to death by their father. 24. Prometheus had been bound by Jupiter with chains to a rock. 25. The affair will become very interesting. 26. It is to be hoped that the enemy has been beaten. 27. A solemn judgment will be held some day after all people have been assembled. 28. Many will be praised who expected censure, and many be censured who expected praise. 29. This youth had been calumniated. 30. His innocence will be recognised, after his honest actions will have been perceived.

THE UNIVERSITIES.—IV.

CAMBRIDGE.—II.

WE resume our remarks upon this University, by endeavouring to give our readers some idea of the expenses which a student will incur in the course of his residence. These will divide themselves into three heads—fees, tuition, and general expenses. Of these, of course, the last is by far the greatest, the second will vary according to the requirements of the student, and the first will form but a small item in comparison with the whole.

Both university and college fees are made to vary with the position or rank of a student, according as he is a nobleman, a fellow-commoner, a pensioner, or a sizar. Three of these names it may be necessary to explain. The great majority of students at the University are called pensioners. They pay the ordinary fees, and the full value of the accommodation which they receive from their college. They dine at the common table in hall, and enjoy no especial privileges. Sizarers are distinguished from these in that, on first going into residence, they declare themselves to need some help towards the expenses of their University course. Formerly the name carried with it an inferior position, but in the present day the avowal of poverty is a protection against many temptations, and is despised by none whose acquaintance is worth cultivating. The fellow-commoner, on the other hand, is one who, either from being older than the majority of undergraduates, or from some other reason, is desirous of mixing rather with the fellows of the college. He pays higher fees, and dines with the fellows in hall, but is allowed no other privileges.

The principal college fees which a man must pay while an undergraduate, are the caution money, the admission fee, and the fee for tuition. The first is paid to the college, and remains in its possession so long as the student's name remains upon the books. Sizarers pay £10, pensioners £15, fellow-commoners £25, and noblemen £50. The admission fee varies at the different colleges between £3 and £5. The terminal payment for tuition—that is, for the care which the tutor of the college takes of the interest of the student and for attendance at the lectures—varies with the position of the student. A sizar pays £2, a pensioner £6, a fellow-commoner £10, and a nobleman £13 Gs. 8d.

We pass now to the University fees. These are paid to the common chest (1) on matriculation, (2) on attending professors' lectures, (3) for the previous examination, and (4) on taking a degree. On matriculation, sizarers and pensioners pay £5; a fellow-commoner, £10 10s.; a nobleman, £15 10s. The total fees on going into residence, therefore, are—for a sizar, £17; for a pensioner, £26; for a fellow-commoner, £45 10s.; for a nobleman, £73 16s. 8d. On passing the previous examination, every student pays £2 10s., and for every series of professors' lectures (one series of which is required from the candidates for the ordinary degree) the fee is £3 3s. On taking the degree of B.A., which is the only one of which we shall speak, every student pays £7 to the University, and a sum varying from £3 to £6 to his college.*

At present we have mentioned only the tuition afforded by the college to all students alike. This, as we have pointed out in our former article, is in most cases insufficient for those who are desirous of taking a good place in any of the honour triposes. It is, of course, almost impossible that a lecturer, who has to deal with perhaps forty or fifty men in the course of an hour, can devote much attention to individuals, however much he may exert himself in his endeavours to do so. Moreover, the course of reading which will be most suitable will vary according to the powers or previous reading of the various students, and a course of lectures cannot therefore be made to suit every one. Hence the necessity for obtaining the assistance of a private tutor in addition to the lectures provided by the college. The average charge per term is about £9. An addition of £36 to the year's expenses is a very important item, and weighs considerably with the poorer class of students in their choice of reading. The above charges are considered to entitle the pupil to one hour's private tuition every other day. But those tutors who take a large number of pupils, usually read with them in classes, which has, at all events, one beneficial effect in exciting a feeling of competition.

The professors' lectures and other sources of instruction remain to be mentioned. Our space would fail us if we attempted to speak of these individually, and we therefore content ourselves with remarking that it is by means of these that the University proper—that is, as distinct from the colleges—gives its instruction. One course, at least, is required of every candidate for the poll degree at the theological examination. In the latter case, the course must be that of one of the divinity professors.

These, then, are the three methods of acquiring knowledge while residing at Cambridge:—By college lectures, which are compulsory, and paid for in the terminal payment to the college tutor; by private tuition, which is voluntary, and ought not to be required by any but candidates for high honours; and by university lectures, which are voluntary except in the case of poll theological men, for whom one course is compulsory.

We pass on now to the question of general expense, apart from fees and tuition. On going into residence, the first question which arises is that of obtaining rooms, the second that of furnishing them. The question is often raised as to the comparative economy of living in college or in lodgings in the town. So many collateral influences affect the matter that it cannot be satisfactorily settled in a general answer. The rent of lodgings is undoubtedly higher, but the outlay in furnishing is avoided, and a man of quiet tastes may certainly lead a more retired life in lodgings than he can in college. But the student must remember that out of college he never really tastes the true flavour of university life.

The rent of lodgings varies from £7 to £15 per term; the rent of rooms in college from £4 to £10 per annum; the average being about £6. In addition to this there is in college the charge for attendance, £1 per term for a bedmaker only, £1 10s. to £2 10s. for a gyp and a bedmaker. Furniture is generally taken on valuation from the preceding occupant of the rooms, but the new-comer is not obliged to take any article which he may not wish for. In this way the expense of

* In addition to the above, non-affiliated students, that is, men who are not members of any college, are now admitted to the privileges of the University. Various expenses connected with the colleges are thereby avoided, the student residing in some of the various licensed lodging-houses, under the surveillance of the University officers. The cost of living in this case may perhaps be estimated at about three-fourths. The fees, however, to the University remain the same.

furnishing is sometimes exceedingly small, £15 being sufficient to fit up, scantily of course, a sitting-room, a bed-room, and a gyp-room. This will not include linen or plate.

All students who are members of a college dine in hall, a certain number of dinners there per week being compulsory. The charge for this varies in the different colleges from 1s. 6d. to 2s. 6d. per day. This comprises a certain dinner, and anything had which is not comprised in the college provision is supplied from the kitchen and charged for separately. As regards breakfast and tea, the student may supply himself if he pleases from shops in the town, but more usually bread, butter, and milk are dealt out from the college butteries every morning to the various bedmakers or gyps for their respective masters. Other things will be kept in stock by the student himself. To sum up briefly the annual expenses while at Cambridge, and taking a very low estimate, we may compute them as follows:—

	FOR A PENSIONER.	£	s.	d.
Tuition		18	0	0
Rooms		8	0	0
Attendance, Gyp and Wife		4	10	0
Coals, about		3	0	0
Cost of living for 25 weeks, at 25s. per week		31	5	0
Sundries, about		5	0	0
Shoe-cleaning		1	1	0
Extras		3	0	0
		£73	16	0

Under the heading "extras" are included all fines, library payments, etc. A sizar's expenditure will be diminished by £12 in the tuition, by £1 10s. in the gyp, and possibly by £3 in the rooms, making the total about £57 6s. This, again, is a very low estimate, and does not include private tuition, clothing, pocket-money, the cook's bill, or any expenses except those which are absolutely necessary during a residence of 25 weeks at the University. Taking everything into consideration, except the expenses of living while away from Cambridge, we should say that the very lowest amount upon which a man can live with anything like comfort is £140 for a pensioner, and £120 for a sizar.

We have now to consider the various means by which a student may partially, and in some cases wholly, defray the expenses of his University course. We have said sufficient on the subject of sizarships. We shall therefore pass on at once to scholarships and exhibitions, whether from the school, the college, the University, or from some mercantile company. To take first the mercantile scholarships. These are given by some of the great City companies to young men, generally sons of freedmen, on their going up to the University, and a prior claim is usually given to those who ask for them on the ground of poverty. They range from £30 to £50 a year.

All the large public schools, and many private ones also, are endowed with exhibitions for the benefit of their elder boys on leaving school. They are given for proficiency in various branches of education, mostly in classics or mathematics. They are the means of sending to the University many boys who, but for the assistance thus given, would be debarred from the privilege. They range from £30 to £70, while some few are even as high as £100 a year.

The pecuniary rewards given by the colleges to undergraduates are of three kinds: minor scholarships, scholarships, and exhibitions. Of these, the first are of recent establishment. They are offered for public competition amongst intending students before going into residence, and are really probationary scholarships, usually lasting for two years, and varying in value from £50 to £70 a-year. The holders of them enjoy all the privileges of scholars. Scholarships are usually given by the colleges for competition amongst their own members. A scholar differs from an exhibitor in that he is on the foundation of the college. His position is higher than that of the ordinary undergraduate, and he receives a certain amount of income, generally £50 a year, from the college revenues. An exhibitor, on the other hand, even though he may receive more money from the college, is not on the foundation, and his exhibition is only given at the option of the master and seniors. A scholarship is usually tenable till the student is of standing to take the degree of M.A.

The highest honour which a student can gain during his undergraduate course is that of obtaining one of the University scholarships or prizes. These vary very much in value, and

are given for proficiency in various subjects, among which classics, mathematics, Hebrew, theology, law, and poetry are included. They are competed for by the best men of all years, and their value to the successful candidate consists as much in the distinction which they confer as in the pecuniary emolument which they bring.

We have thus endeavoured to give our readers some slight sketch of the University and of its internal dealings with its own members. We shall consider in another article the local examinations which it holds, both for youths and young women, in various parts of the country.

LESSONS IN CHEMISTRY.—XXV.

METALS PROPER—continued.

LEAD—continued.

DRY air has no action on lead; but if moisture be present, the bright surface of the metal is soon tarnished by a closely-adhering film of oxide. Lead, on account of its pliability, is much used for water-pipes and cisterns; but it should never be used for storing rain-water, for this is pure water containing air, and in such water the oxide of lead is soluble, rendering the liquid poisonous. Well-waters, containing nitrates and chlorides, act on lead, forming soluble salts, therefore they should not be brought in contact with it; but hard waters have little or no action on the metal, for a thin deposit of sulphate or carbonate is formed on its surface, preserving it from further attack. However, water charged with carbonic acid gas is capable of dissolving the lead carbonate to a dangerous extent.

Lead is used in several alloys: *shot* is composed of lead, which is alloyed with a little arsenic, to render it hard and more easily granulated. The other important alloys have been mentioned. There are three other oxides of lead.

Plumbic oxide, or *litharge* (PbO), is a yellow powder formed when lead is heated in a current of air. It is soluble in caustic, potash, or soda; and if the solution be allowed to stand, carbonic acid is gradually absorbed from the air, the alkali rendered a carbonate, and the lead oxide deposited in transparent dodecahedral crystals. Litharge is capable of fusion, and then combines with glass, etc., forming fusible plumbic silicates. It is largely used as a flux, and for glazing earthenware. A solution of it in lime-water is prepared for a hair-dye. The lime partially decomposes the hair, when the lead with the sulphur in the air forms lead sulphide, staining the hair black.

Peroxide of Lead, or *Plumbic Dioxide* (PbO_2), is a brown powder obtained by digesting red-lead in nitric acid. It can be decomposed by a high heat, becoming litharge, and giving off oxygen. With sulphuric acid a sulphate is formed, and oxygen comes off; with hydrochloric acid chlorine is evolved, and a plumbic chloride is made.

Minium or *Red Lead* (PbO, PbO_2) is a compound of the other two oxides; it is obtained by heating plumbic oxide or *massicot*, but not sufficiently to fuse it into litharge; it absorbs oxygen, and becomes bright red. Its chief use is in the manufacture of flint glass; it is also employed to colour inferior sealing-wax and in paper-staining. At a high temperature it parts with some of its oxygen and becomes litharge.

Plumbic Carbonate, or *White Lead* (PbO, CO_2), is the well-known paint; it may be obtained in a state of purity by precipitation from a solution of a plumbic salt by an alkaline carbonate. To procure it in large quantities, sheets of lead are exposed to the simultaneous action of acetic acid and carbonic acid. This is effected by placing the sheets rolled into coils in earthenware pots, at the bottom of which is some crude vinegar (acetic acid); these pots are packed in manure, from the fermentation of which the carbonic acid is supplied. The acetic acid, volatilised by the heat of the fermentation, attacks the metal oxidised by the air, forming acetate of lead (sugar of lead). The carbonic acid gradually displaces the acetic acid from its combination, and thus the plumbic carbonate is formed.

Lead Sulphide (PbS).—Galena has been noticed as the chief ore of lead. Artificially, this compound may be produced by passing a current of sulphuretted hydrogen through a solution of a lead salt. Dilute nitric acid causes this compound to deposit its sulphur; but if the acid be strong, both the lead and the sulphur are oxidised, forming a lead sulphate.

Plumbic Chloride ($PbCl_2$) is precipitated from a solution of the nitrate by the addition of sodium chloride. It combines

with lead oxide in several proportions; with 7 molecules of the oxide it forms *Turner's yellow*; with one molecule a white paint is produced, which is prepared by Bell of Newcastle. "Cassol's yellow" is still more basic.

Iodide of Lead (PbI_2) falls as a beautiful yellow precipitate when an iodide is added to a lead solution.

The other salts of lead afford nothing of peculiar interest. The oxalate is the most insoluble, and therefore its precipitate offers a good test for the presence of the metal.

Besides the characteristics of these salts, already mentioned, lead may be reduced with ease on charcoal; thus its presence is by no means difficult to ascertain.

The *Noble Metals* have already been defined to be those which are capable of being reduced from their oxides by heat. They are nine in number: Mercury, silver, platinum, gold, palladium, rhodium, ruthenium, osmium, and iridium.

MERCURY OR QUICKSILVER.

SYMBOL, Hg—COMBINING WEIGHT, 200—SPECIFIC GRAVITY, 13.59—DENSITY OF VAPOUR, 100.*

Occasionally mercury is found native, disseminated in small globules through the rock. Its chief ore is *cinnabar* (mercuric sulphide). The extraction of the metal is simple, and is effected either by heating the ore in retorts, burning off the sulphur, and distilling the mercury; or by mixing the ore with some body like quicklime, with which the sulphur combines, the metal as before distilling off.

Cinnabar is mined in many parts of the world: Almaden, in Spain, and Idria, in Carniola, are the most important European mines.

The metal is imported into England in iron bottles. With most metals it forms amalgams; but the film of oxide, ever present on the surface of iron, prevents the amalgamation of that metal. At -40° it becomes a solid, crystallising in octahedra; at 350° it boils; but at all temperatures it seems to give off vapour. In the Torricellian vacuum, the space above the mercurial column in a barometer, globules of mercury may often be found condensed on the tube.

Hydrochloric acid has no action upon it; with sulphuric acid a sulphate is formed, sulphurous acid coming off. The action with nitric acid is violent, nitrous acid gas being copiously evolved; when triturated with sulphur or iodine, it will unite with them.

Its action on the human frame is serious, producing salivation; and the workmen are subject to "mercurial palsy," a peculiar form of nervous debility.

Black Mercurous Oxide (Hg_2O) and the *Red Mercuric Oxide* (HgO) are the only oxides. The former is obtained by the action of potash on mercuric nitrate or on calomel. It is a dark-grey powder, and when heated is decomposed into metallic mercury and

Red Mercuric Oxide.—This oxide may be prepared by heating the metal in the air to a temperature of 300° ; but this process is slow, and the one generally adopted is the decomposition of mercuric nitrate by cautiously heating. In a state of fine subdivision it is yellow; such is the case when it is precipitated by potash from a solution of the nitrate.

The sulphides correspond to the oxides.

Mercurous Sulphide (Hg_2S) is a black powder, and may be procured by the action of sulphuretted hydrogen, or a mercurous salt.

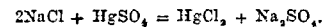
Mercuric Sulphide (HgS) is the ore cinnabar, or *vermillion*. It is prepared artificially by heating together sulphur and 6 times its weight of mercury; the black mass thus formed is placed in tall earthen pots, the lower parts of which are red-hot. The top is then closed, and after thirty-two hours the vessel is opened; the sublimation being complete, the vermillion is found deposited on the upper parts of the vessel.

Mercurous Chloride, or *Calomel* (Hg_2Cl_2), is usually prepared by triturating 17 parts of corrosive sublimate, moistened with 13 parts of mercury, and then subliming. It is a white powder decomposed by the alkalis, but insoluble in water. It is largely used in medicine.

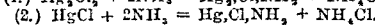
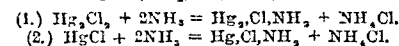
Mercuric Chloride, or *Corrosive Sublimate* ($HgCl_2$), is formed when mercury burns in chlorine, or when mercuric oxide is dissolved in hydrochloric acid; it is usually prepared by subliming a

* The density of its vapour is 100, being an exception to the rule.

mixture of salt and mercuric sulphate. In this instance the action is—



It is also decomposed by the alkalis, but is soluble in water; it is a violent poison. The white of eggs (albumen) is the antidote, since with this substance an insoluble compound is formed. The action of ammonia on these chlorides is peculiar, a molecule of amidogen (NH_2) replacing an atom of chlorine:—



Mercurous Iodide is a green powder, formed when any mercurous salt is acted on by potassium iodide; it easily decomposes, even by light, into

Mercuric Iodide, which is a brilliant red colour, formed with mercuric salts and potassium iodide; it is soluble in an excess of the latter solution. The mercurous salts are distinguished from the mercuric salts by the addition of a chloride, when calomel falls.

The salts of mercury are readily recognised by the appearance of the metal when they are submitted to heat.

SILVER.

SYMBOL, Ag—COMBINING WEIGHT, 108—SPECIFIC GRAVITY, 10.5.

Silver, the most beautiful of the metals, is frequently, though not plentifully, met with in a native state; it is often combined with mercury, antimony, and gold; but usually is found as a sulphide, with the sulphur ores of lead, antimony, copper, and iron.

The chief silver mines are those of Peru and Mexico; Kongsberg, in Norway; and Schneeberg, in Saxony.

Its extraction from lead has been already noticed.

To liberate the metal from its ores the method of *amalgamation* is often resorted to, which consists in reducing the silver to the state of a chloride by roasting the crushed ore with salt; then it is placed with pieces of iron in barrels of water, which are made to revolve. The iron becomes a chloride, and the metallic silver is liberated. Mercury is now added, with which the silver amalgamates. The mercury is then distilled off, and the silver remains.

The metal is the best conductor of heat and electricity, and exhibits extraordinary ductility.

Silver is largely used in the arts, but is then usually alloyed, to give it the requisite hardness for wear. Standard silver, of which coins are made, contains 7.5 per cent. of copper. Since it is capable of receiving the highest polish, it is much used for reflectors. When melted it possesses the remarkable property of absorbing oxygen from the air; this it liberates again on cooling, and hence the surface of a cooled mass is covered with bubbles, from which the oxygen has escaped.

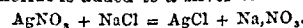
There is reason to believe that three oxides exist: the sub-oxide (Ag_2O), the silver oxide (Ag_2O), and the neutral peroxide (Ag_2O_2).

The *Silver Oxide* (Ag_2O) is precipitated as a brown powder when potash is added to a solution of argentic nitrate.

When this powder, freshly precipitated, is digested for some hours in ammonia, *fulminating silver* is the result, which must be carefully dried in small quantities on pieces of blotting-paper.

Argentic Nitrate ($AgNO_3$) is produced when the metal is dissolved in nitric acid. It may be obtained in tabular crystals; it is soluble in its own weight of cold water. When fused it is sold as *lanar caustic*. With organic matter, in sunlight, it undergoes decomposition, staining the body with black suboxide. This property is the foundation of photography.

Argentic Chloride ($AgCl$) falls as a white, curdy precipitate whenever a chloride is added to a silver solution:—



When heated strongly it melts; and when cool it is named *horn-silver* from its appearance. To reduce the silver from the chloride, it is only necessary to moisten it with dilute sulphuric acid, and place a piece of zinc in contact with it; a gradual transfer of the chlorine from the silver to the zinc takes place. In sunlight it changes colour, becoming purple, with a loss of chlorine. It is readily soluble in ammonia.

Argentic Iodide (AgI) is the most sensitive to light of the silver salts; this is the reason why the collodion of the photographer is iodised, so that when the plate is immersed in the bath of argentic nitrate, on its surface may be formed a film of iodide of silver.

Argentic Sulphide (Ag_2S) is found as the mineral "silver glance." Sulphuretted hydrogen precipitates it from a silver solution; it falls as a black powder.

The presence of silver is easily detected by the precipitation of the chloride. Copper, zinc, and iron precipitate metallic silver from its solutions; mercury produces the crystalline deposit, which is an amalgam, and is known as "*arbor Diana*." Phosphorus also becomes coated with silver when suspended in an argentic solution.

Mercury, lead, and silver are distinguishable by the action of their chlorides with ammonia.

The chloride of silver is soluble—that of lead insoluble; while the chloride of mercury is blackened.

RECREATIVE NATURAL HISTORY.

THE HARE AND RABBIT.

The hare (*Lepus timidus*) is a timorous animal, and all its characteristics are in keeping with its timid disposition. It has no canine or tusk-like teeth wherewith to tear up other animals more defenceless than itself. It is a harmless animal, and from those that are harmful it tries to escape by its fleetness of foot. In a hunting country like England it is well known, because it can run so well for short periods of time that it outstrips both horse and hound, thus affording sport to the hunters as they dash over miles of hill and dale. It has other enemies besides man—cats, weasels, birds of prey, &c. Like the early American trapper, who was used to sleeping with one eye shut and the other open, while a finger was on the trigger of the gun he held, so these hares, ever alive to the danger they are in, sleep with both their eyes open, ready to start off at the first sign of danger, seeking for safety only in precipitate flight. Sometimes when hunted the hare has been known to practise various devices in order to elude its pursuers—such as returning on its own scent; betaking itself to furze bushes, and leaping from one to another; getting up into the hollow of a tree; throwing itself into a river and floating with the stream for some distance, or swimming out into a lake with only the nose above water. It also seems to prefer to run uphill, which it manages with undiminished speed—seeing that its fore-legs are shorter than the hind ones—while the speed of its pursuers is considerably retarded. The animal would no doubt be able to escape from the hunter, were it not for the folly it exhibits in doubling back to the place whence it started from. Sometimes, when far ahead of its pursuers, it will stop, and, rearing itself on its hind legs, look back to assure itself that it has escaped from the harriers. They are soon within sound and sight again, and finally overtake it. When seized by the hounds, the poor hare utters a sharp loud cry, not unlike the cry of a child. It is only in time of pain and danger like this that its voice is ever heard.

The common hare is found throughout Europe, and in some parts of Asia. It is of a tawny red on the back and sides, and white on the belly. Its ears are long and tipped with black; its eyes large and prominent, placed backwards in its head so that it can nearly see behind it as it runs. It is not so prolific as the rabbit. The female goes with young about a month, and generally has three to six in a litter. The young are born with their eyes open, are suckled for twenty days, after which they leave the dam to procure their own food.

There are many kinds of hares, the common hare (*Lepus timidus*) being regarded as the type of the family of them.

One of the more remarkable members of this family is the Alpine hare (*Lepus variabilis*), which changes the colour of its coat with the seasons, a peculiarity which probably is of some benefit to it. In summer its soft fur is grey, with an intermixture of yellowish brown; the ears are tipped with black, and the tail is grey above and white beneath. On the approach of winter the fur gradually becomes white, except on the points of the ears and on the lips, where the fur remains black. It will be observed that in winter it takes the colour of the snow, like the arctic fox and ermine—a change which may subserve the two ends of (1) enabling it the better to escape from enemies, which will not be so well able to distinguish it against a white ground as they would have been had it retained its summer colours; and (2) making it warmer and more comfort-

able, the white fur being probably warmer than the grey and yellowish brown.

Belonging to the family of hares, we have also the rabbit (*Lepus cuniculus*), which is so common an animal that there is probably no one who is not familiar with it. A craze for rabbit-keeping among lads is about as common a complaint as the measles, and probably many a reader of this article will remember the interest he used to take in the inmates of the hutch when he paid his periodical visits to see after their welfare, and the solicitude he felt for the cases of pot-belly, snuffles, scurf, &c., that he may have had on his hands during his rabbit-keeping experience. The knowledge he then gained would make it difficult for us to tell him anything new about the ways of these pets, and we shall therefore confine ourselves to an account of some facts which he may not know.

The rabbit is not so big as the hare, and its hinder legs are shorter. It is supposed to have been introduced from Spain into the various countries of Europe in which it is now found. In the wild state, rabbits have a great uniformity of colour; in the domesticated state, the greatest diversity. The colour of the fur of the wild rabbit is brown, with its tail black above and white beneath; but domesticated rabbits are white, black, fawn, yellow, grey, or slate colour, &c. With the uniform colour of the wild rabbit there is associated nearly unconquerable wildness; with the varied colour of the domesticated rabbit, a state of extreme tameness. On this matter of tameness of the domesticated animal, Darwin remarks: "Hardly any animal is more difficult to tame than the young of the wild rabbit; scarcely any animal is tamer than the young of the tame rabbit."

We must attribute at least the greater part of the inherited change from extreme wildness to extreme tameness to habit and long-continued confinement."

The doe commences to breed when from six to eight months old. It would perhaps be hard to find any back-boned animal that is more prolific. Naturalists generally assert that it will breed seven times in a year; but a rabbit-fancier, with an eye to producing a fine breed, will not allow a doe to have more than four litters a year. There are generally about eight young ones in a litter. If we suppose, then, that the guiding hand of the fancier is not over them, a pair of rabbits would have fifty-six young ones in one year. These would pair in the following year, and have a numerous progeny, so that there would soon be quite a colony. A lively conception of their rapid multiplication will be obtained if the reader make a rough calculation of how many descendants a couple of rabbits would have in four years, supposing they had seven litters a year, with eight young ones in a litter in equal numbers of males and females. Upon making the calculation, it will be found that the original pair have, at the close of the fourth year, over a million descendants, consisting of sons and daughters, grandchildren, great-grandchildren, and great-great-grandchildren. A truly patriarchal pair!

Rabbits have lots of enemies—the cat, dog, and man himself,

&c. So numerous, indeed, are their enemies, that if they were not so prolific they might soon become extinct. Of extinction, however, there is not much fear, for if climate and surroundings are suitable, their numbers steadily increase, notwithstanding the ravages of their enemies. Goldsmith relates that in Spain and some of the islands of the Mediterranean, where their numbers were not sufficiently checked by man, they multiplied to such an extent as to become a positive pest to the natives. The aid of soldiers was demanded to destroy them, for they were becoming a plague, but an efficient check was found in the introduction of the ferret.

In our own times, indeed, a similar experience is being now passed through. Rabbits have been introduced into Australia and New Zealand, and there is now a loud outcry against them.

These rodents are vegetarians in the strictest sense of the word, living on nothing but vegetable products. Hares, for example, live upon roots, leaves, fruits, and corn, quenching their thirst with dew, and during winter they will eat the bark of trees. The domestic rabbit is fed on grain, meal, hay, clover, vetches, comfrey, dandelion, &c.

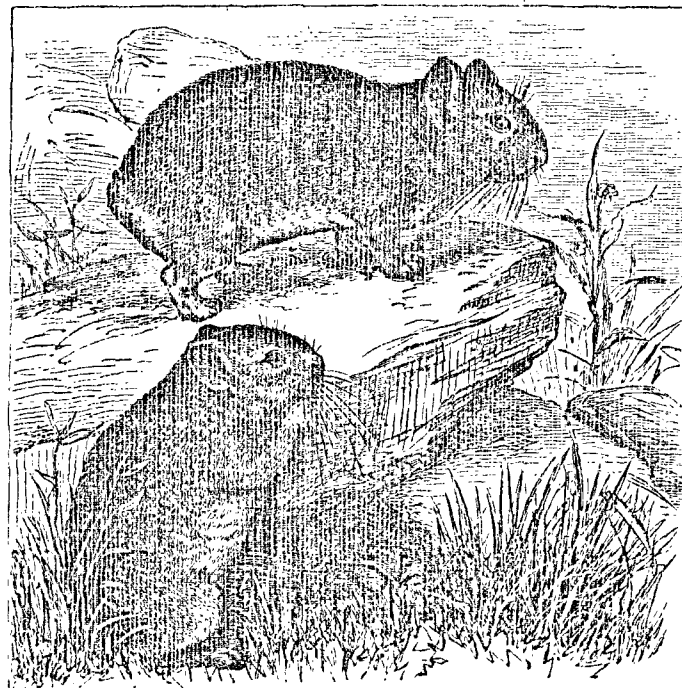
There are several varieties of rabbits. The lop-eared breed is highly esteemed by fanciers. In this breed the ears appear abnormally long, measuring across from tip to tip as many as twenty inches. In some other breeds the ears are erect. Any striking peculiarity in any breed is made more pronounced by a discreet process of selection in breeding.

The so-called calling hares, or pikas (*Lagomys*), differ in many structural points from the *Leporidae*, or hares and rabbits, the most manifest of these differences being their much lesser size, apparent absence of tail, shorter ears, and their possessing four limbs of nearly

equal length. The pikas, or calling hares, have also a habit of whistling, which has earned for them their latter appellation. Nearly a dozen species have been described.

The Alpine pika (*Lagomys alpinus*) is a small animal, from nine to nine and a half inches long, which inhabits Siberia. It is of a greyish brown colour above and yellowish grey beneath. It generally burrows in the ground, and is nocturnal in its habits, seldom coming out in the day-time, except on a dull and cloudy day. It feeds on the scanty herbage of the higher regions of Siberia, and displays a wise foresight in providing for the long and dismal winters, when food would be unobtainable because of the covering of snow, by piling up small stacks of herbage for winter use.

Taking them altogether, the hares, whether *Leporidae* or *Lagomys*, are a poor defenceless class of animals, harmless, and nearly helpless, preyed on by every kind of bloodthirsty animal, and preying on none. Such of their characteristics as are protective to the race have been gradually improved by nature's selecting hand, so that now there is nothing so fleet of foot as the common hare, and nothing so prolific as the rabbit. Our pity for them may be misplaced, as no doubt their lot, such as it is, best tends to their own and other animals' welfare.



THE ALPINE PIKA.

LESSONS IN GEOLOGY.—IX.

LITHOLOGY—PETROLOGY—GEOLOGICAL TERMS.

UNDER the general term *Geognosy* is included all that can be said in relation to the structure of the matter composing the earth's crust. Such a description readily permits of a sub-division.

The rock-masses may be treated of as to their mineral, their internal structure, and those characters which may be determined by handling specimens, such as texture, construction, hardness, etc. All this is *Lithology*.

Petrology describes the larger characteristics of rock; the relative positions they occupy, and the disturbances they have undergone.

Neither of these sub-divisions treats of rocks arranged in geological groups. Hence this forms a third part of the subject, and to enable us to classify rocks chronologically—that is, to determine which rocks were deposited at or about the same time—we must appeal to their organic contents. The mineral composition is of little service. For instance, two sandstones, identical in their composition, may be found, which we know must have been formed at two periods separated by vast intervening ages; and this we discover by their fossil contents. Hence a study of fossils is of the greatest importance, and this has received the name of *Palaeontology*.

Mineralogy is a further sub-division of *Lithology*.

Lithology, as we have said, treats of the mineral composition of the rocks, but does not enter into the chemistry, etc., of these mineral elements. Thus we find the remark we made in the opening lesson is true. To be a perfect geologist we must begin with Chemistry. This teaches us the elements whereof all bodies are composed, and the laws of their combination. A step higher, and we reach *Mineralogy*, by which we are taught how those elements are arranged in bodies contained in the solid crust of the earth; the forms in which minerals appear, and their characteristics. *Lithology* groups these minerals into rocks, and forms the third division of our subject; *Petrology* tells how the rocks lie on the surface, their contortions, interstratifications, etc.; while *Palaeontology*, from the fossils the rocks contain, groups them according to their ages, and writes a history of the animal life of the globe. *Mineralogy* will be treated separately; and for a further description of the minerals we shall have occasion to name, we refer the reader to the forthcoming lessons.

Technical Terms Descriptive of the Structure and Internal Characters of Rocks.—Although the particles of a mineral may be arranged in a symmetrical order, forming a *crystal*, this formation never extends to large masses. No crystal has been discovered more than one or two feet long; but when a rock is composed of particles which are either crystals or fragments of crystals, it is said to be *crystalline*. Such is the structure of loaf-sugar. The granites and many of the primary rocks exhibit it. Occasionally a uniform structure is developed in large masses of rock; this is always *columnar* (Fig. 14), as in the basaltic rocks of the Giant's Causeway, in the north of Ireland, and in Fingal's Cave, on the opposite shore of the Isle of Staffa.

The number of the sides of the columns varies from three to ten. They fit so closely to each other that the blade of a knife is with difficulty inserted between them. When broken horizontally they exhibit a *conchoidal fracture*; that is, the surface of one piece is concave, the corresponding surface of the other being of course convex—like a ball-and-socket joint.

The origin of the columnar structure of rocks was proved experimentally by Mr. Gregory Watt. He caused a quantity of basaltic rock to be fused in a blast furnace. When a small portion of this was removed and allowed to cool, it assumed a *vitreous* character; that is, like glass, but not transparent. If a

larger quantity were treated in the same manner, the basalt returned to its former stony appearance; but in doing so, it was observed that the molten mass congregated into little balls, and these increased in size by the continuous addition of more matter to their external coating. In due time these balls touched each other; but as their increasing capacity still continued, they were squeezed together; and as the expansive force progressed, their curved surfaces were flattened. Presuming the force in each ball to be exactly the same, by this process *hexagonal* (six-sided) short prisms would be produced. This will be sufficiently evident from Fig. 15.

For some reason or other these spheres arranged themselves one above the other, so that a straight line would pass through their centres. This explains the formation of the columnar structure.

Certain green stones are found which appear in *spherical* masses. When exposed to the weather they are liable to *exfoliate*; that is, one coat after the other peels off, thus demonstrating their *concretionary* character, or that they were made by successive layers accumulating round a nucleus, probably in the same manner as the globules of basalt, in which the columnar structure originated.

All masses of rock are intersected by regular sets of cracks, which are termed *joints*. Without these it would be difficult to quarry stratified rocks, and impossible to hew out hard primary rocks.

Joints generally traverse rocks at right angles to each other. In granite quarries three sets frequently cut the stone into cubical masses.

Their existence can only be accounted for by supposing they result from the shrinkage of the mass upon its consolidation. When these joints are very close to each other, and pass through the rock-mass in the same direction, the phenomenon is termed *cleavage*, and the rock splits into slates. Some stratified rocks readily divide into horizontal slabs, the planes of division coinciding with those of stratification. Such slabs are called *flags* or *flagstones*.

When the rock exhibits a disposition to break up into thin leaves, it is said to be *laminated*. *Shales* are clayey deposits which were once soft and plastic, but upon drying became intersected by numerous joints, which cause the mass to split up into small pieces.

Crystalline rocks are frequently found possessing a laminated structure; they are then *schists*, or of a *schistose* structure. Occasionally the term *foliated* is applied to rocks of this nature, from the leaf-like manner in which the layers overlies each other. *Fissile* is a general term which characterises all rocks which show any tendency to break up into small parts.

When a layer of rock reposes on a stratum of different material, its under surface must partake of smoothness or inequality of that stratum; this is denominated *bedding*. A stratum of rock is sometimes called a *bed*, but the word is becoming geologically obsolete. *Seam*, unfortunately, has two meanings; sometimes it is used to indicate the line which marks in a section the junction of two strata, and also it is applied to thin layers of mineral matter which traverse a series of strata. For example, thin beds of coal, a few inches or even feet thick, are frequently found at intervals in many strata; these would be called *seams of coal*. It is evident how the word has become applicable to each case. The thin bed was considered the line which divided the two layers of strata.

The above terms are descriptive of the structure of rock-masses. On examining a specimen in the hand, a closer inspection reveals to us its internal characters. If it be made up of the same kind of matter, the rock is *homogeneous*; when its particles are in grains, perceptible to the touch or plainly visible, the specimen is *granular*. Occasionally the material is arranged in fibres, as asbestos; it is then *fibrous*. When the fibres are distinct, long, fine crystals, it is said to be *acicular* (needle-like).

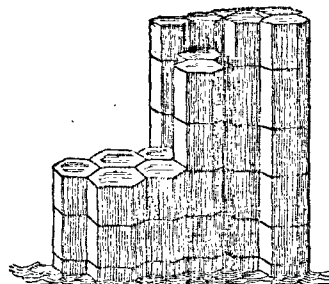


Fig. 14.

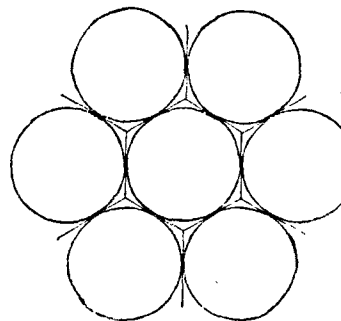


Fig. 15.

A compact rock has its particles in close and firm proximity, but one which is friable permits of being crumbled. A porous specimen is full of holes, like pumice-stone, but when the pores are small it is said to be cellular or vesicular. Rocks are hard or soft, but beyond a general application these terms are not much in vogue. In mineralogy we shall find that much stress is laid on the comparative hardness of minerals.

Rocks which are composed of water-worn pebbles cemented together are conglomerates. If angular fragments take the place of the pebbles, a breccia is the result, which word is the Italian for "fragment." A pebble is a small piece of mineral matter, worn round by the action of water. When the sea-beach is not sand, but stones rounded by the waves, the accumulation of pebbles is a shingle.

If the size of the pebble exceed a few pounds in weight, it becomes a boulder.

A stratum which has been deposited by aqueous agency is of one of three characters. It is either of an arenaceous quality—that is, a sandstone; or it is argillaceous—that is, a clay; or it is a limestone.

In each of the great systems in which rocks are classified, these three species of rocks appear. Each system has its limestone, its sandstone, and its argillaceous rocks, or its clay beds.

Sand, of which arenaceous rocks are composed, is properly small particles of quartz, which is the hardest constituent of granite, and therefore most successfully resists the process of attrition.

Quartz is pure siliceous or flint, and may at once be recognised in a specimen of granite, as those clear, semi-transparent grains. When granite decomposes, these grains remain intact, or nearly so; for siliceous is most difficult to dissolve. Particles of sand are always rounded, as if by the action of running water.

Sandstone is an aggregate of these particles, which are held together in some cases without any apparent cement; but often calcareous or siliceous matter is present in a small quantity, which binds the arenaceous particles together. Sometimes clay or the oxide of iron forms this cement, and to this latter substance the red colour which frequently tints sandstones is due. Some fine-grained sandstones are found which contain minute scales of shining matter; this is mica, another constituent of granite, and such rocks are termed micaceous sandstones. These sandstones are found among the earlier formations.

Grit is applied to sandstones whose grains are very coarse.

Argillaceous Rocks.—Any earth which is sufficiently plastic to be kneaded by the hand is, in common language, a clay. Strictly speaking, clay is composed of siliceous and aluminous particles. Kaolin, or porcelain clay, is the finest of the clays. Its composition is given in this table, in which it is compared with other specimens:—

	Kaolin.	Stourbridge Fire Clay.	Pipe Clay.	Blue Clay.	Brick Clay.
Silica	50.5	64.10	53.66	48.38	49.44
Alumina	33.7	23.15	32.00	38.04	31.26
Iron Oxide	1.8	1.83	1.35	1.04	7.74
Lime	—	—	0.40	1.20	1.48
Magnesia	0.8	0.95	—	—	5.14
Potash	1.9	—	—	—	—
Soda	—	—	—	—	—
Water	11.2	16.00	12.08	13.57	1.94
	99.9	100.05	99.49	100.23	100.00

All clays are formed by the very fine disintegrated particles of water-worn rocks. Mud is matter also formed of such particles, but it contains a mixture of animal or vegetable matter, or both. Shale is hardened clay, but if it be softened by water it will exhibit the plastic properties of that body. All clays when breathed upon emit a peculiar earthy smell.

Calcareous Rocks.—All rocks of this description may be at once discovered by the application of a few drops of any acid. Effervescence at once takes place, owing to the escape of carbonic acid gas, which is always associated with lime, forming a carbonate of that base.

There are many varieties of limestone. Chalk, as we have said, is due to the incessant work of minute animalcules, which separate the lime from the sea-water to form their calcareous

coverings, mixed with the shells of larger inhabitants of the ocean.

Marble is also carbonate of lime which has been submitted to the action of heat, and thereby rendered crystalline.

Mountain limestone is so called because it appears in ranges of hills. It is very compact and dark-coloured. The walls in many parts of Ireland are built of this admirable material, which is found in great quantity in that island. In Sweden there is an instance where a vein of granite has passed through a mass of mountain limestone. This it rendered like marble where it had contact with it, and the white crystalline rock gradually shaded away to its original dark condition. The colour of this stone is considered to be due to carbon in a state of minute sub-division; but the quantity is so small as to evade detection by chemical means.

Oolite is a species of limestone which appears in little round grains, like the roe of fish; hence its name. Each of these grains has a particle of sand for a nucleus, round which the limestone seems to have congregated.

When magnesia is present in a quantity as much as thirty-five per cent., the rock is termed dolomite.

When clay and sand are mixed in a considerable quantity with lime, a loam is formed. When only a little sand is present, and the mixture is of a more firm texture than a loam, it is denominated a marl. It is not a usual thing to find any limestone pure; they all contain an admixture of foreign matter.

These are the general characteristics of the great divisions of rocks. Those deposits which are peculiar to the various formations will be alluded to in their proper places.

LESSONS IN GREEK.—XXII.

THE NUMERAL ADVERBS

DENOTE how many times a number is to be taken, as "six times six make thirty-six." Here six times is a numeral adverb; thus, *dis* signifies twice, *tris* three times. The termination of the numeral adverbs is in general -*akis* (-*akis*, -*takis*), which is annexed to a cardinal, as *τεσσαράκισ*, *έξakis*, *έκατοντάκισ*.

THE NUMERAL ADVERBS.

1. <i>άπαξ</i> .	18. <i>οκτωκαίδεκάκισ</i> .
2. <i>dis</i> .	19. <i>εννεακαίδεκάκισ</i> .
3. <i>tris</i> .	20. <i>εικοσάκισ</i> .
4. <i>τετράκισ</i> .	30. <i>τριακοντάκισ</i> .
5. <i>πεντάκισ</i> .	40. <i>τετταρακοντάκισ</i> or <i>τεσσαρακοντάκισ</i> .
6. <i>έξakis</i> .	50. <i>πεντηκοντάκισ</i> .
7. <i>έπτάκισ</i> .	60. <i>έξηκοντάκισ</i> .
8. <i>οκτάκισ</i> .	70. <i>έβδομηκοντάκισ</i> .
9. <i>εννεάκισ</i> , <i>εννάκισ</i> .	80. <i>ογδοηκοντάκισ</i> .
10. <i>δεκάκισ</i> .	90. <i>ενενηκοντάκισ</i> .
11. <i>ένδεκάκισ</i> .	100. <i>έκατοντάκισ</i> .
12. <i>δωδεκάκισ</i> .	200. <i>διακοσάκισ</i> .
13. <i>τρισκαίδεκάκισ</i> .	300. <i>τριακοσάκισ</i> .
14. <i>τετταρεσκαίδεκάκισ</i> or <i>τεσσαρεσκαίδεκάκισ</i> .	1000. <i>χιλιάκισ</i> .
15. <i>πεντεκαίδεκάκισ</i> .	2000. <i>δισχιλιάκισ</i> .
16. <i>έκκαίδεκάκισ</i> .	10,000. <i>μυριάκισ</i> .
17. <i>έπτακαίδεκάκισ</i> .	20,000. <i>δισμυριάκισ</i> .

RECAPITULATORY EXERCISES FROM THE CLASSICS.

1. Αναχαρίεις κρείττων ελεγεν, ένα φίλον εχειν πολλου αξιον, η πολλους μηδενος αξιους. 2. Άντων, δ' πρσβυτερος, εκ της λιβυης επερασε μεγαλην δυναμιν εις Σικελιαν, πεζων μυριάδας πεντε, ίππεις δε έξakisχιλίου, ελεφαντας δε έξηκοντα. 3. Τους Σηρας ίσπορουσι μεχρι τρισκοσίων (ην ετων, και τους Χαλδαιους υπερ τα έκατον ετη βιονν λογος (εστι). 4. Αργανθωνιος, δ' Ταρτησσων βασιλευς, πεντηκοντα και έκατον ετη βιωσαι λεγεται. 5. 'Ο Πλατων τελευτησε τω πρώτῳ της ογδῳς και έκατοστος Ολυμπιαδος, βιος ετος έν προς τοις ογδοηκοντα. 6. Δημητριος τις ειπε τῳ Νερωνι· συ μεν απειλεις μοι τον θανατον, σοι δε ή φους. 7. Σχολαστικος απορων, τα βιβλια αυτου επιπρασκε, και γραφων προς τον πατερα ελεγε, συγχαίρε ήμιν, πατερ, ηδη γαρ ήμας τα βιβλια τρεφει. 8. Αναχαρίεις δ' Σκυθης ερωτηθηκε υπο τινος τι εστι πολειμον ανθρωποις; αυτοι, εφη, έαντοις. 9. Σχολαστικος οικιαν παλων, λιθον απ' αυτης εις δειγμα περιεφερε. 10. Κριττης ων, αι ταύτα περι των αντων γινωσκει, ουδεν προς χαριν ποιων. 11. Ψυχης επιμελου της σεαυτον. 12. Βουλου αρσκειν πασι. 13. Παντων μαλιστα σεαυτον αισχυνου. 14. Ραυτον άπαντων εστι

αυτον εξαπαταν. 15. Ω αγαθε, μη αγνοει σεαυτον. 16. Ιφικρατης σκυτοτομου μεν υιος ην, ενδοξοτατος δε. Ουτος ειπε προς τινα των ευγενων· το μεν εμον γενος απ' εμου αρχεται, το δε σον εν σοι παυεται. 17. Θαλης ερωτηθεις, τι κοινοτατον; απεκρινατο ελπις· και γαρ οis αλλο μηδεν, αυτη παρεστιν. 18. Οιον το ηθος έκαστον ταυτους δ' βιος. 19. Φερεται δ' Νειλος απο των Αιθιοπικων δρων μεχρι της εις θαλασσαν εκβολης σταδια μυρια και δισχιλια. 20. Τα δις πεντε δεκα εστιν. 21. Εντευθεν εφελαινε σταθμους δυο, παρασάγγας πεντε, επι τον Σαρῳν ποταμον, ου ην ευρος τρια πλεθρα.

VOCABULARY.

1. Αξιος, -α, -ον, *worth, worthy*; πολλ. αξ., *of great value*.
2. Άντων, -ανος, δ, *Hanno, the Carthaginian general*. Επερασε (from *περα*, beyond), *transported, carried over*; πεζων (from *πεζος*), *of foot-soldiers*; ίππεις (ίππευς), *horsemen, cavalry*.
3. Σηρας (Σηρ, -ος), the *Seres, an Eastern people who produced silk*; ην (inf. of *ζω*, I live), *to live*; Χαλδαιους, the *Chaldeans*; τα έκατον ετη, *literally, above the hundred years* (so with either number the article is used when a whole is contemplated; in constructing into English you must drop the article in such cases): βιονν (from *βιω*, I live, *βιος, life*), *to live*.
4. Βιωσαι, *to have lived*; λεγεται, *is said*.
5. Ετελευτησε (from *τελος*, an end), *came to an end, died*; Ολυμπιας, -αδος, ή, an *Olympiad, a period of five years* (the Greeks reckoned time by Olympiads, as we date from the birth of Christ, A.D.); βιος, *having lived*; ετος έν, etc., *one year to eighty, that is 81 years*.
6. Ειπε, *said*; Νερων, -ανος, δ, the *Roman emperor Nero*; απειλεις (from *απειλω*, I threaten), *threatenest*.
7. Σχολαστικος, -ου, δ, an *idler, a witling*; απορων, *being in difficulties*; επιπρασκε, *sold*.
8. Ερωτηθεις (ερωταω, I ask), *being asked*; εφη, *said, answered*.
9. Δειγμα, -ατος, το, a *specimen*; περιεφερε (περι and *φερω*), *carried about*.
10. Γινωσκει, *pronounce the same judgment*; προς χαριν ποιων, *doing nothing for favour*.
12. Αρεσκειν, *to please*; βουλου, *wish (try)*.
13. Αισχυνου (αισχυνομαι), *reverence*.
14. Εξαπαταν, *to deceive, cheat*.
15. Αγνοει, *be thou ignorant*.
16. Σκυτοτομος, -ου, δ, a *leather cutter* (from *σκυτος*, -ους, το, a *hide, leather*); ευγενης, *well-born*; αρχετ. απ. εμου, *literally begins from me, that is, with me*; παυεται, *comes to an end*.
17. Απεκρινατο (απο and *κρινω*), *answered*; ελπις, *hope*; και γαρ, *for*.
19. Φερεται, *carries itself* (middle voice), *flows*; εκβολη, -ης, ή, a *falling out of*; μεχρι, *up to, down to, until*.
21. Εφελαινε, *marches*.

EXTRACTS FROM THE NEW TESTAMENT.

1. Ειπε δε δ' Ιησους, Ποιησατε τους ανθρωπους αναπεσειν. Ην δε χορτος πολυς εν τῳ τοπῳ. Ανεπεσον ον οι ανδρες τον αριθμον· ος πεντακισχιλιοι (John vi. 10). 2. Πολλοι δε των ακουσων τον λεγον επιστευσαν· και εγενηθη δ' αριθμος των ανδρων· ος εις χιλιαδες πεντε (Acts iv. 4). 3. Και ειδον και ηκουσα φωνην αγγελου πολλων κυκλω του θρονου και των ζων και των πρεσβυτερων· και ην δ' αριθμος αυτων μυριαδες μυριαδων· και χιλιαδες χιλιαδων, λεγοντες φωνη μεγαλη, Αξιον εστι το αρνιον το εσφαγαμενον λαβειν την δυναμιν και πλουτον και σοφian και ισχυν και τιμην και δοξαν και ευλογian (Rev. v. 11, 12). 4. 'Ο εχων νουν ψηφισατω τον αριθμον του θηριου· αριθμος γαρ ανθρωπου εστι, και δ' αριθμος αυτου (understand εστι) χξγ (Rev. xiii. 18). 5. 'Ο δε Ιωαννης διεκωλυεν αυτον, λεγων, Εγω χρειαιν εχω υπο σου βαπτισθηναι, και συ ερχη προς με; (Matt. iii. 14). 6. Αλληλων τα βρη βασταζετε, και ούτως αναληρωσατε τον νομον του Χριστου (Gal. vi. 2). 7. 'Η γαρ καυχησις ήμων αυτη εστι, το μαρτυριον της συνειδησεως ήμων, ότι εν όπλοτητι και ειλικρινεια θου, ουκ εν σοφια σαρκικη αλλ' εν χαριτι Θεου, ανεστραφημεν εν τῳ κρημνι, περισσοτερας δε προς υμας (2 Cor. i. 12). 8. Ει τις ον παρακλησις εν Χριστῳ, ει τι παραμυθιον αγαπης, ει τις κοινωνια πνευματος, ει τινα σπλαγγνα και οκτιρμοι, πληρωσατε μου την χαραν, ινα το αυτο φρονητε, την αυτην αγαπην εχοντες, συμψυχοι, το έν φρονουντες, μηδεν κατα εριδειαν η κενοδοξian, αλλα τη ταπεινοφροσυνη αλληλους ήγουμενος υπερειχοντας έαυταν, μη τα έαυτων έκαστος σκοπουντες, αλλα και τα ετερων εκαστος (Philippians ii. 1—4).

VOCABULARY.

1. Ιησους, *Jesus*; ποιησατε (ποιω, I make, do), *make, cause to*;

αναπεσειν (πιπτω, I fall), *to sit down*; χορτος, -ου, δ, *grass*; ανεπεσον, *they sat down*; τον αριθ., *as to number, that is, in number, or to the number*; οςαι, *about*.

2. Των ακουσων. (ακουω, I hear), *of those who heard*; επιστευσαν (πιστις, faith), *believed*; εγενηθη (γινωμαι, I become), *was, rose to*.

3. Ειδον (ειδος, appearance, shape), *I saw*; ηκουσα, *I heard*; αρνιον, -ου, το, *lamb*; εσφαγαμενον (σφαγιον, a victim).

4. 'Ο εχων νουν, *let him who has*; ψηφισατω (ψηφος, a pebble; the Greeks usually reckoned with beans, as the Latins did with pebbles, *calculi*, whence *calculate*), *calculate*.

5. Διεκωλυε (κωλυω, I hinder), *tried to hinder*; βαπτισθηναι, *to be baptised*; βαπτω, I dip; ερχη, *comest thou?*

6. Βασταζετε (βασταζω, I carry), *bear*; ούτως, *thus*; αναπλη. (ανα, up; πληρωω, I fill), *fill up, fulfil*.

7. Καυχησις, -εως, ή, *boasting*; συνειδησις, -εως, ή, *conscience*; απλοτης, -ητος, ή, *simplicity*; ειλικρινεια, -ας, ή, *sincerity*; σαρκος (σαρξ, flesh), *fleshly*; ανεστραφημεν, *we have behaved* (conducted) *ourselves, we have acted*; περισσοτερας (περι, denoting abundance), *more exceedingly*.

8. Παρακλησις, -εως, ή, *exhortation, comfort*; παραμυθιον, -ου, το, *solace, soothing*; κοινωνια, -ας, ή, *community*; πνευμα, -ατος, σπινι; σπλαγγchon, -ου, το, *bowels*; οκτιρμοι, -ου, δ, *pity*; πληρωσατε (πληρωω, I fill), *fulfil*; φρενιτε (φρενες, the mind), *that ye desire, aim at, love*; συμψυχοι (ψυχη, the soul), *being of the same soul, of one soul*; επιθεια, -ας, ή, *strife*; κενοδοξia (κενος, empty), *vain glory*; ταπεινοφροσυνη, -ης, ή (ταπεινος, humble), *lowliness of mind*; ήγουμενος, *thinking, considering*; υπερειχειν, *to be superior*; σκοπουντες (σκοπειν, to look, hence επισκοπειν, to overlook, whence our word *bishop*), *looking at*.

REMARKS.

The pronouns are among the oldest words in every language. Consequently, if in two languages the pronouns are found to have strong marks of resemblance, we may safely conclude that those two languages are akin to each other. Such marks of resemblance may be found by comparing the Greek and the English personal pronouns together. Thus the Greek *εγω*, through the Latin *ego*, is clearly the English *I* (also the German *ich* and the French *je*). Look at the Greek accusative *με*, the Latin *me*, and the English *me*. Again, compare the Greek *συ*, the Latin *tu*, and the English *thou*; also the accusatives, namely, *σε, te, thee*. The *ε* (the *ε* aspirated and so made *he*) is obviously our *he*.

Similar remarks may be made with regard to the numerals. Obviously in structure, as well as in individual numbers, the Greek numeral system is the same as our own.

The student, if he has well attended to these lessons, may now rejoice in having made some considerable progress; and the progress he has made he may in a measure estimate by the comparative ease with which he has just read passages from the Greek New Testament.

GENERAL VIEW OF WHAT HAS BEEN SET FORTH.

Noun Substantive, used to name objects, as *στρατιωτης*, soldier (a soldier).

Article, used to determine nouns, as δ *στρατιωτης*, the soldier.

	of quality,	αγαθος στρατιωτης,	good soldier.
	of number,	δεκα στρατιωται,	ten soldiers.
	of order,	δεκατον ταγμα,	tenth legion.
		ουτος δ ανθρωπος,	this man.
		εκεινος δ ανθρωπος,	that man.
	demonstrative,	δ αυτος ανθρωπος,	the same man.
		αυτος δ ανθρωπος,	the man himself.
		ανθρωποι τινες,	some men.
	interrogative,	τις ανθρωπος,	which man?
	relative,	δ ανθρωπος δς,	the man who.
	possessive,	δ εμος πατηρ,	my father.

Pronoun, *εγω, I*; *συ, thou*; *ου, of himself*.

KEY TO EXERCISES IN LESSONS IN GREEK.—XXI.

EXERCISE 70.—GREEK-ENGLISH.

1. The river Euphrates is four stadia in breadth. 2. The stadium of the Romans contains one hundred and twenty-five steps, or six hundred and twenty-five feet. 3. To Cyrus there were present thirty-five ships from Peloponnesus. 4. The breadth of the Sarus, a river of Cilicia, was three plethra. 5. The plethron contains a hundred feet. 6. Cydnus, a river of Cilicia, is two plethra wide. 7. The

breadth of the Meander, a river of Phrygia, is twenty-five feet. 8. The parasang, that is, Persian measure, contains thirty stadia, or eighteen thousand seven hundred and fifty feet. 9. The calculation of the entire journey, the expedition and retreat, which is described by Xenophon, was two hundred and fifteen stadia, one thousand one hundred and fifty-five parasangs, thirty-four thousand six hundred and fifty stadia; and the length of time of the expedition and retreat was a year and three months. 10. The friendship of one intelligent person is better than the friendship of all unintelligent people. 11. This was the number of the army of Cyrus: of the Greeks there were ten thousand four hundred hoplites, two thousand five hundred targeteers; but of the Barbarians with Cyrus, there were one hundred thousand, and scythe-bearing chariots about twenty.

EXERCISE 71.—ENGLISH-GREEK.

1. Εἰς συνέτος φίλος ἐστὶ κρείττων πολλῶν ἀσυνέτων. 2. Τα εἴδη ἐξδομή-
κοντα ποιεῖ ἀμφὶ τὰς ἡμέρας διαμυρία πεντέ, πεντακοντίας καὶ πεντηκοντίας καὶ
πεντέ. 3. Ὅλος ὁ ἀριθμὸς τῆς οὔρου ἀπὸ τῆς μαχρῆς ἐν βαβυλωνί εἰς τὰ Κοτῶρα
ἢ ὑπὸ Ξενοφῶντος συγγραφεῖται σταβμοὶ ἑκατὶν εἰκοσι, δύο παρασάγγαι
ἑξακοντοὶ εἰκοσι σταδία μυρία οκτακισχίλια ἑξακοντα, χρόνον δὲ τὸ πλῆθος
ὀκτὼ μῆνες. 4. Ὁ ἀριθμὸς τοῦ στρατεύματος ἐστὶ τρισμυριοὶ ἐνδοκισχίλιοι
ὀκτακοντοὶ καὶ πεντηκοντα. 5. Εἰσι τεσσαρες στρατηγὸς τοῦ στρατοῦ ἑκατέρω-
των στρατιῶν τρισμυριοὶ ἐνακοντοὶ καὶ εἰνηκοντα. 6. Πορταν ἐν τῇ
μαχρῇ τρεῖς τρισμυριοὶ καὶ ἑξακισχίλιοι ἑξακοντοὶ καὶ πεντηκοντα τῶν στρατιῶν,
καὶ ἄρματα δρεπανηφόρα ἀμφὶ ἑκατὸν καὶ πεντηκοντα.

GEOMETRICAL PERSPECTIVE.—XII.

IN proportion as the number of lines and angles increase, which compose the subject to be represented in perspective, so there will follow a greater amount of working lines, drawn in various directions from the picture plane. Under these circumstances it will frequently be necessary to use more than one line to represent the PP, in order to prevent the confusion which must occur when working all the details from one PP only. Therefore we are at liberty to use any number of lines as picture planes—

an advantage fully appreciated by every draughtsman when engaged in making highly-finished drawings of very elaborate subjects. The kind of work to which these lessons are but an introduction, and which must fall to the lot of those who have studied perspective for some practical purpose, will not be restricted to cubes, blocks of wood, and the simple objects we have selected for our practice, and to assist us in explaining the principles. We know the same rule for

drawing a block in perspective is applied again in drawing a church or a palace; but respecting the latter, that which increases the labour, and not unfrequently perplexes the student, is the increased amount and the great variety of details. We intend still to confine ourselves to simple examples, so long as we have any new rule to give or fresh principle to explain; let these be well learnt, then the application of them to more extensive and important subjects will be easy. We now, therefore, introduce the practice of additional picture planes, and that our explanations may, we trust, be clearer, we will simplify the process by proposing a problem with reference to two slabs or blocks only, of the same size, and each in the same position with regard to the PP. By this time our pupils will be prepared with the fact, that if an object touches the picture plane its real length is represented upon the picture; and as it retires from or beyond the picture, the space it occupies

upon the PP diminishes. Turn to Fig. 24, Vol. II., page 360, where the slabs of the pavement touching the PP are drawn to the size given by the scale; also *f e*, the perpendicular edge of the cube in Fig. 33, Vol. III., page 9, is another example. After this remark, it will be seen that the object may be made to touch the PP in more than one place, if it is placed at a distance from the PP, by means of one or more of its lines being produced to the PP as points of contact. Therefore, if we have the option of placing a line representing the PP anywhere in conjunction with one of these points of contact, besides our usual practice of putting it below the drawing, we have the advantage of distributing the measurements, which might be crowded upon this one line, upon other lines similarly placed for the same purpose. Any further remarks will be made as we proceed with the method of drawing the following problem:—

PROBLEM XXXV. (Fig. 57).—Two slabs or rectangular blocks, each of the same dimensions, 6 feet long, 4 feet broad, and 1 foot thick. One block is above the eye, the other below, resting on the ground; in every other respect the conditions of each are the same. Their long sides are 40° with the PP; their nearest angles 3 feet to the left of the eye, and 2 feet within the PP. Height of the eye, 4 feet, and distance of nearest angle to the eye 10 feet. The vertical space between the blocks is 6 feet.

Our motive for employing two blocks of the same dimensions and position, with the one exception named, is that we shall find it easier to explain; and we hope our pupils will more clearly understand the use of the PP when placed above the eye, and by which we intend to show that the proportions of the object can with equal capability be arranged upon a line above the HL, as upon one below it. By this use of two lines to represent the PP, the base of a column can be worked from the PP below, and the capital from the one above. The same may be observed when representing windows, balconies, etc., in the upper storeys of a large building. From *rs* on the HL draw the semicircle DE^1E DE^2 . (We have stated the distance of sight in a way frequently done in some of the military examination papers, for the purpose of drawing attention to it. It is said that the distance from the nearest angle to the eye is 10 feet, and that the object is 2 feet within or beyond the PP; therefore the eye will be 8 feet from the PP, which length will be the radius for describing the semicircle through *E*.) The distance of the nearest angle of the object to the left of the eye will be at *b*; *c*

the nearest point of the object to the PP, from which lines must be drawn to both vanishing points; the perspective lengths of *c d* and *c e* must be cut off by lines to their respective distance points in the way already explained in Lesson IX., Vol. III., page 271. The line *c d*, which has been drawn to VP^1 , must be produced to the PP in *h*. The thickness of each block is 1 foot, that being added to the vertical space between them will be 8 feet; therefore the perpendicular line, or line of contact, must be 8 feet from *h* to *i*. Another PP through *i* must be drawn parallel to the HL. Now, as the blocks in this case are the same in their dimensions and positions, the upper one could be very quickly and conveniently drawn from the lower one, by raising perpendicular lines from the angles; but we avoid this for a special reason: that is, we wish our pupils to go through the construction again, upon and from the upper PP, in the same way as they did from the lower;

the nearest point of the object to the PP, from which lines must be drawn to both vanishing points; the perspective lengths of *c d* and *c e* must be cut off by lines to their respective distance points in the way already explained in Lesson IX., Vol. III., page 271. The line *c d*, which has been drawn to VP^1 , must be produced to the PP in *h*. The thickness of each block is 1 foot, that being added to the vertical space between them will be 8 feet; therefore the perpendicular line, or line of contact, must be 8 feet from *h* to *i*. Another PP through *i* must be drawn parallel to the HL. Now, as the blocks in this case are the same in their dimensions and positions, the upper one could be very quickly and conveniently drawn from the lower one, by raising perpendicular lines from the angles; but we avoid this for a special reason: that is, we wish our pupils to go through the construction again, upon and from the upper PP, in the same way as they did from the lower;

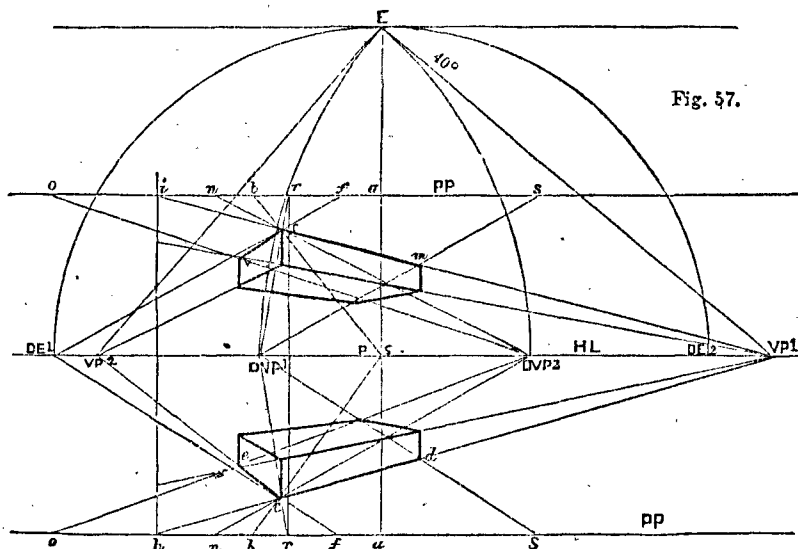


Fig. 57.

afterwards, a repetition of the process, when, in a future case, the object above varies in size and form from the one below, the difficulties will not be so great. Probably it will be advisable to recapitulate some of the work, to prevent failure. Make *a b* equal to the distance the object is to the left of the eye; draw *b rs*; make *b f* equal to the distance the nearest angle is within the picture; and because the line from *b* vanishes at PS , therefore the line from *f*, to cut off the point within, must be drawn to VP^1 , the distance point of *x* or *rs*, to determine the nearest part of the object *c*. (Some writers on Perspective call the *DE* the *DPS*, meaning the distance of the point of sight. It makes no practical difference, because *DE^1* or *DE^2* represents the space between the eye and the picture plane, that is, between *E* and *rs*; *rs* being on the picture plane, which is supposed to be in a perpendicular position; the line below, marked *PP*, being its base.—See Fig. 21, Vol. II., page 360.) Through *c*, directed from DVP^1 , draw a line to *r*; make *rs* equal to the length of the block; draw from *s* back again to DVP^1 , which will cut the vanishing line from *c* to VP^1 in *m*; *cm* will then be the perspective representation of the length of the block. Through *c*, directed from DVP^2 , draw a line to *n*; make *no* equal to the width of the block, and rule from *o* back again to DVP^2 ; this will cut the line from *c* to VP^2 in *v*; *cv* will be the width of the block. We trust the remainder of the work, including the thickness of the block, will present no difficulties.

We will make further use of this problem, by changing the proportions of the upper block to 4 feet long, and 2 feet wide; its plan being in the centre of the plan of the lower one. In this case a plan must be drawn both of the blocks and the PP, to show how the former are situated and connected with the latter, and from which we obtain the proportions and distances of the several parts from one another and from the PP. Therefore Fig. 58 is the first consideration; it is a plan constructed according to the particulars given in the question. Draw the PP. Anywhere, say from *a*, draw the line *a b*, at an angle of 40° with the PP. Upon this last line find the point *d*, the nearest angle within the PP; draw *d c* perpendicularly with the PP; place *rs* 3 feet

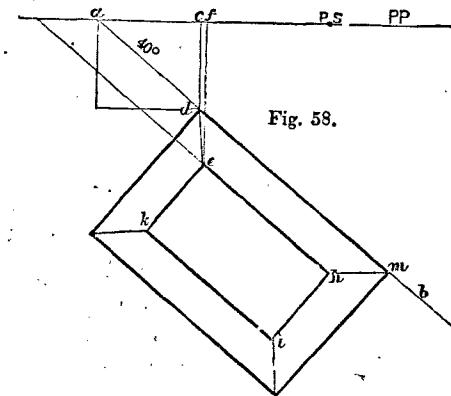


Fig. 58.

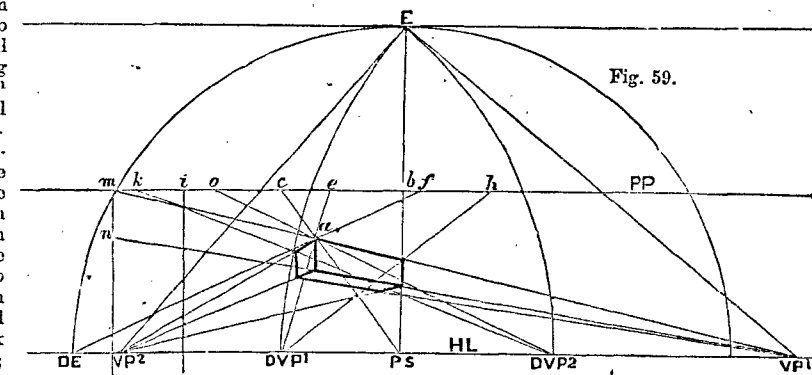


Fig. 59.

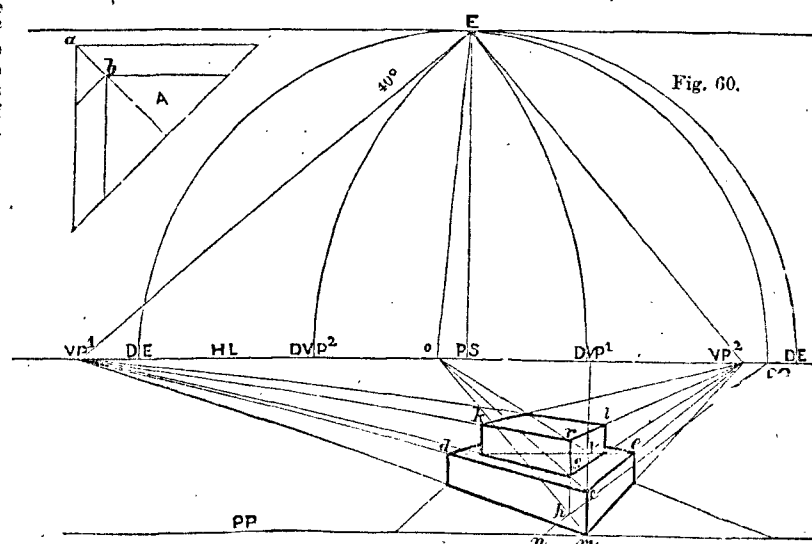


Fig. 60.

to the right of *c d*. Upon *d m* draw the plan of the lower block; afterwards the plan of the upper one, *e h i k*; all its sides being one foot within the larger plan. In Fig. 59 we have represented only the upper block; the lower one will be simply a repetition of the one in Fig. 57, which our pupils must not omit repeating when drawing Fig. 59. We will now commence with the HL, and proceed upwards. The *E*, *DE*, *PP*, and *PS* will be the same as in Fig. 57. The distance of the nearest angle *a* from the PP must be measured from *b* to *c* on the PP, and equal to *rs c*, taken from Fig. 58. The distance *c f*, of the point *a* within, must be equal to *f e* (Fig. 58). Draw from *a* to VP^1 , and also the other way to the PP in *m*; a line from *m* perpendicularly to *PP* will be the line of contact, upon which to measure the thickness, *m n*, of the block. The length and breadth to be cut off on the lines which vanish to VP^1 and VP^2 must be taken from the plan, viz., *e h* for the length, and *e k* for the breadth, as shown in *e h* and *o k* (Fig. 59). It

will be noticed that the difference of dimensions between the two blocks, and the greater distance of the lower block from the PP, causes a change of position for the line of contact, or rather, another line of contact must be introduced. The perpendicular from *i* is the line of contact for the lower block, whilst the one from *m* will be the line of contact for the upper; proving that in all cases the first part of the construction to be considered is the position of the nearest point of the object, with regard to the eye and the PP; leaving the rest to whatever may result from the work, according to the varied character of the subject, and the conditions given in the statement.

Before we make any further application of the rule and process of the above problem, we will explain another important step connected with this part of our subject, and afterwards combine the two in an especial case.

Our next consideration will be the way in which we can make use of a diagonal line for determining retiring distances and retiring proportions; that is, the angle which the diagonal makes with the PP (we will suppose it to be the diagonal of a square). The diagonal is obtained by bisecting the angle formed by the vanishing lines from *x* to VP^1 and VP^2 ; its *VP* and distance point

DP found, and in all respects treated as are the vanishing lines of retiring sides.

PROBLEM XXXVI. (Fig. 60).—Two square slabs of different dimensions, the smaller of which is lying upon the other; the planes of their centres coincide; the nearest angle of the lower one touches the PP. The side of the larger slab is 4.5 feet; the smaller, 3 feet. Thickness of each, 1 foot. Angle of sight, distance, and height of the eye, as in the last problem.

A portion of the subject represented by the plan A must be constructed, for the purpose of obtaining the length of that part of the diagonal line between a and b. As the angles of the object are right angles, therefore the angle formed by the vanishing lines from E to the HL will be a right angle. Bisect it by the line E o; E o will then be the vanishing line of the diagonal of the slabs, and o the VP. Find its distance point by drawing from o the arc E DO. After the lower slab, m c d e, is drawn according to previous instructions, produce the perpendicular m c through v; make m c and c v equal to the thickness of the slabs; in other words, mark their heights on the line of contact from m. Draw the diagonals m o, c o, and v o; also the diagonal d e. Our object now is to determine the nearest angle of the upper slab. Upon the diagonal of the base, m o, we must cut off the distance of a b, in the plan A. Make m n equal to the line a b, and from n draw a line to DO, cutting the retiring diagonal m o in h; m h will then be the perspective distance of a b. From h draw the perpendicular h s; this perpendicular, cutting the diagonal from c, gives the nearest angle of the upper slab in s; c v being the measured thickness of the upper slab, therefore s r is the perspective thickness. The diagonal d e, cutting the retiring base of the upper slab from s each way, gives the perpendicular edges at l and k. The remaining retiring lines must be directed to their respective vanishing points.

LESSONS IN ARITHMETIC.—XLVI.

EXERCISE 64.—MISCELLANEOUS EXAMPLES.

1. Reduce to a proper fraction—

$$\frac{2\frac{1}{2} + \frac{1}{2} - 2\frac{1}{2}}{3\frac{1}{2} + 2\frac{1}{2} - 4\frac{1}{2}} \times \frac{\frac{2}{3} - \frac{1}{3}}{\frac{1}{3} - \frac{1}{3}} \div \frac{\frac{2}{3} + \frac{1}{3}}{\frac{1}{3} + \frac{1}{3}}$$

2. How many bricks 9 inches long, 4½ broad, and 4 thick, will be required for a wall 30 feet long, 20 feet high, and 4 feet thick, allowing 6½ per cent. of the space for mortar?

3. When hay was £5 per ton, a well-to-do farmer hid himself in a load, and his weight, of course, was added in that of the hay. Before the hay was shipped, the trick was detected; and after another weighing, 7s. 6d. was deducted from the price. Find the farmer's weight.

4. A room is 20 feet long, 16 broad, and 12 high. If pure gold be worth £4 5s. per oz. Troy, and a cubic foot of gold weigh 19260 oz. avoirdupois, what is the value of the gold which will exactly fill the room?

5. A wine-merchant buys 12 dozen of port at 84s. per dozen, and 60 dozen more at 48s. per dozen; he mixes them, and sells the mixture at 72s. per dozen: what profit per cent. does he realise on his original outlay?

6. How many cubes of which the sides are 2½ inches can be cut out of a cube of which the side is 22 inches?

7. A young lady desires to paper her room with postage-stamps, but being herself unable to calculate the number which will be required, she supplies the following data:—Her room is 14 feet 9 inches long, 9 feet 3 inches broad, and 10 feet 6 inches high; it contains two windows, each 5½ feet by 4 feet, and three doors, each 6 feet by 3 feet; a postage-stamp is ½ of an inch long, and ¾ of an inch broad. Make the calculation for her.

8. The daily issue of the Times is 60,000 copies. Three days of the week it consists of 3 sheets, and for the remaining three of 4 sheets. If a sheet be 3 feet long and 2 feet broad, find the number of acres which the weekly issue of the Times would cover.

9. Express ¾ of 7s. 6d. + 625 of 10s. — 545 of 9s. 2d. as a decimal fraction of £10.

10. Among how many men must £73 be divided in order that the share of each may be £4 17s. 4d.? And among how many must £79 17s. 6d. be divided in order that half of them may have 10s. 7d. each, and the other half 7s. 2d. each?

11. Find the length of the side of a square which is equal in area to the rectangle, the sides of which are 513 yards 1 foot 11 inches and 1628 yards 11 inches.

How much would it cost to cover the area with turf at 4½d. per square yard?

12. If 100 lbs. of tea be bought at 4s. 4d. and sold at 5s., and 100 lbs. of sugar bought at 6d. and sold at 7d., what profit per cent. will be realised on the whole outlay?

13. The removal of a quantity of brick earth, 32 square yards in area and of a uniform depth of 2 yards, costs £2 2s. 8d.; what is the cost of the removal of a cubic yard?

14. A person's average annual expenditure, from the year 1830 to the year 1850 inclusive, is £391 9s. 2d. He finds that in 1830 he spent £391 16s., and in 1851, £445 8s. 9d. What was his average annual expenditure from 1831 to 1851 inclusive?

15. In Austria 120 gulden (paper currency) are worth 100 silver gulden. What amount of paper money should be obtained for £10 sterling if the value of £1 be 9 gulden 30 kreutzers in silver (60 kreutzers = 1 gulden)?

16. What sum at £4 per cent. compound interest will amount in two years to £405 12s.?

17. A room is 60 feet long by 29 feet wide; how many people can be seated in it on chairs 1½ feet wide, and placed 2 feet apart from back to back, allowing a clear passage 3 feet wide down the middle of the room and a space of 15 feet deep at one end?

18. Divide 296.293 by 41.967 so as to have six decimal places in the quotient.

19. Find the length of the longest chain in terms of which 88 yards 2 feet 5 inches and 119 yards 2 feet 1 inch can both be expressed as integers.

20. By selling at 4½ per cent. profit, a tradesman gained £47 14s.; what was the prime cost of his goods?

21. The interest on a certain sum of money for two years is £71 16s. 7½d., and the discount on the same sum for the same time is £63 17s., simple interest being reckoned. Find the rate per cent. and the sum.

22. A barters some tea with B for flour which is worth 2s. 3½d. a stone, but uses a false pound weight of 15½ oz. What value should B set upon his flour that the exchange may be fair?

23. A garrison consisting of 2000 men, finds during a siege that it has provisions for six weeks; at the end of a fortnight 400 men are killed in a sally. How long will the provisions last?

24. Find the expense of painting a room 23 feet 6 inches long, 12 feet 7 inches high, and 17 feet 6 inches broad, at 3s. 6½d. a square yard.

25. The gold procured from Australia in nine months in 1851 amounted to 313644 ounces. In 1861, the New Zealand gold-fields yielded 314433 ounces in the same time. What is the excess in weight and value (at £3 17s. 10½d. per ounce) of the average monthly return from New Zealand over that from Australia?

26. Find the difference between the amount of £247 10s. for two years, and the present worth of the same sum due after two years at 5 per cent.

27. How many bricks, of which the length, breadth, and thickness are 9, 6, 3 inches respectively, will be required to build a wall whereof the length, height, and thickness are 72, 8, and 1½ feet?

28. Express as the fraction of £10 the difference between £8½ and £3 × ¾; and find the value of ¾ of a ton of sugar when ¾ of a ton is worth £6 5s.

29. Find two numbers whose greatest common measure is 179, and least common multiple 56385.

30. In which way had one better buy sugar, at 3 guineas per cwt., or at £2 16s. 4d. per quintal of 100 lbs.? and how much is one buying when the gain by the more advantageous way is a guinea?

31. On what sum is the daily interest at 4 per cent. one penny?

32. If 16 daries make 17 guineas, 19 guineas make 24 pistoles, 31 pistoles make 33 sequins, how many sequins are there in 1851 daries?

33. Which way had one better buy coffee, at 6 guineas a cwt., or at £5 12s. 4d. per quintal of 100 lbs.? And how much is one buying, when the loss on the less advantageous way is £1?

34. If 2 guineas make 3 napoleons, and 15 rix-dollars make 4 napoleons, and 6 ducats make 7 rix-dollars, how many ducats are therein £490?

35. Three per Cents. are offered at 90½, Five per Cents. at 150½; in which should one invest? And how much is one investing when the difference of income is £1?

36. How much ore must one raise that, on losing 1½ in roasting, and 1½ of the residue in smelting, there may result 506 tons of pure metal?

37. An analysis of the Board of Trade returns for 1861 respecting shipwrecked lives gives the following results:—Saved by lifeboats, 13½ per cent.; by rocket and mortar apparatus, 8 per cent.; by ships' boats, etc., 62 per cent.; by individual exertion, 1½ per cent.; lost, 16 per cent. Determine the number of lives saved by the several means enumerated, corresponding to a loss of 864 lives.

38. A monolith of red granite in the Isle of Mull is said to be about 108 feet in length, and to have an average transverse section of 113 square feet. If shaped for an obelisk it would probably lose one-third of its bulk, and then weigh about 600 tons. Determine the number of cubic yards in such an obelisk, and the weight in pounds of a cubic foot of granite.

39. A person invests £5187 10s. in the Three per Cents. at 85, and when the funds have risen to 85, he transfers three-fifths of his capital to the Four per Cents. at 96. Find the alteration in his income.

40. Find the square root of 767376, and the length of the side of a square whose area is equal to that of a rectangle, the sides of which are 47½ yards and 210 yards.

41. A and B contract to execute a certain order for £1245. A employs 100 children for 3 months, 80 women for 2 months, and 40 men for 1 month; B employs 120 children for 2 months, 60 women for 1½ months, and 80 men for 2½ months. If the work done in the same time by a child, a woman, and a man be in the ratio 1 : 2 : 3, find the sum of money which A and B must each receive.

42. The area of the coal-field of South Wales is 1000 square miles, and the average thickness of the coal is 60 feet. If a cubic yard of coal weigh 1 ton, and the annual consumption of coal in Great Britain be 70,000,000 tons, find the number of years for which this coal-field alone would supply Great Britain with coal at the present rate of consumption.

43. If the coal annually consumed in this country (70,000,000 tons) were piled up into a pyramid, having for base the great court of Trinity College, Cambridge, the dimensions of which are 110 by 90 yards, find the height of the pyramid. (N.B. The volume of a pyramid is equal to the area of the base multiplied into one-third of the height.)

44. A man invests £4297 10s. in the Three per Cents. at 95½. He sells out one-third of his stock when the funds have fallen to 94, £1600 stock when they have risen to 96½, and the remainder at par. What sum does he gain?

If he invest the proceeds in the French Three per Cents. at 67½, what is the difference in his income, 25 francs being taken as equivalent to £1?

45. Gunter's Chain is taken along the line A D (920 links) in the six-sided field ABCDEF; the distances of the points B, C, E, F from A D are 182, 250, 190, 136 links, meeting it at points 120, 560, 750, 95 links from A. Find the acreage of the field. (N.B. The area of a triangle is half the rectangle contained by its base and its height.)

46. A ring weighs 1 dwt. 4 gr., and is worth £1 2s. If 1050 such rings be packed in a box weighing 3½ lbs., what would it cost to convey them 144 miles at the rate of 5s. per ton per mile, insurance being demanded at the rate of ¼ per cent.?

47. If £1 exchanges for 24½ francs, and the French Three per Cents. are selling for 70½ francs, what amount of the latter stock will £539 buy?

48. A contractor engaged to make 2½ miles of road in 84 days; but after employing 60 men for 54 days, he found they had only finished 380 yards. How many additional men must be employed to finish the work within the prescribed time?

49. The fall in the price of paper was 1½d. per lb., and the weight of a certain book 1½ lbs. The paper manufacturer realised 10 per cent. on his sale, and the publisher 20 per cent. on his outlay. What reduction might be made in the price of the book on the fall in the price of paper, allowing to each tradesman the same rate of profit as before?

50. How soon will a sum double itself at 12½ per cent. compound interest?

51. The external length, breadth, and height of a rectangular wooden closed box are 18 inches, 10 inches, and 6 inches respectively, and the thickness of the wood is ½ inch. When the box is empty, it weighs 15 lbs.; and when filled with sand, 100 lbs. Compare the weights of equal bulks of wood and sand.

52. The sum of £177 is to be divided among 15 men, 20 women, and 30 children in such a manner that a man and a child may together receive as much as two women, and all the women together receive £60. What will they respectively receive?

READINGS IN FRENCH.—XII.

JACOPO.

SECTION III.

ÉLISA, un peu rassurée par la promesse de son oncle, commença, d'une voix tremblante, son récit. Elle raconta comment elle avait renversé la petite paysanne, et comment ses œufs avaient été brisés.

"Allons! c'est très-bien, Élisabeth, tu as été franche; comme ce n'est pas trop ton habitude, je veux t'en récompenser en me chargeant de solliciter aussi ta mère en ta faveur."

"Maman," dit alors Napoléon, "j'ai encore une grâce à vous demander. Vous me donnez dix sous par(e) semaine pour mes menus plaisirs. Eh bien! achetez de payer les œufs de cette pauvre petite qui attend là ce que tout cela va devenir, et vous ne me donnerez plus rien jusqu'à ce que nous soyons quittes."

"D'accord," dit Madame Lucette en faisant approcher la petite paysanne, et lui donnant un petit écu. "Napoléon, en voilà pour six semaines."

L'enfant courut à Napoléon, et voulut lui remettre les deux pièces de monnaie qu'elle avait reçues de lui au moment où l'accident était arrivé; mais il refusa.

Cette prohibition plut à Madame Bonaparte, qui alors interrogea la petite paysanne. Elle apprit que c'était la fille d'un pauvre pêcheur, que sa mère était malade, qu'elle demeurait dans une chétive cabane, sur le bord de la mer, à quelque distance de l'endroit où son panier avait été renversé.

"Ta mère est malade, dis-tu, mon enfant?" elle n'a pas de médecin qui la soigne, sans doute. J'irai la voir."

"Oh! maman, je vous en prie," s'écria Napoléon, "allons-y tout de suite." Nous reconduirons Charlotte."

"Volontiers," répondit Madame Bonaparte. "Allons, mes enfants, partons."

Les enfants ne se le firent pas répéter. Quelques instants après, ils arrivèrent au pied d'un rocher.

"C'est là," dit Charlotte, en désignant une misérable cabane.

Lorsqu'ils entrèrent, un jeune garçon de douze ans était occupé à faire un filet; une toute petite fille était assise à terre et mangeait une croûte de pain; une enfant, beaucoup plus jeune encore, dormait dans un berceau cassé, couvert d'une vieille courteline presque en lambeaux.

COLLOQUIAL EXERCISE.

- | | |
|---|--|
| 1. Que raconta la petite Élisabeth? | 12. Où demeurait la famille du pêcheur? |
| 2. Que lui dit alors son oncle? | 13. Où leur cabane était-elle située? |
| 3. Que promit encore l'archidiacre? | 14. Que dit Madame Bonaparte à l'enfant? |
| 4. Que dit Napoléon à sa mère? | 15. Que dit alors Napoléon? |
| 5. Que proposait-il à l'égard des œufs cassés? | 16. Madame Lucette lui accordait-elle sa prière? |
| 6. Que lui répondit Madame Lucette? | 17. Où arriva-t-on quelque temps après? |
| 7. Que fit alors la petite paysanne? | 18. Que dit Charlotte et que désignait-elle? |
| 8. Napoléon accepta-t-il l'argent? | 19. Que virent-ils en entrant dans la maison du pêcheur? |
| 9. Quel fut l'effet de cette action de la petite fille? | 20. Où dormait le plus jeune des enfants? |
| 10. Que fit alors Madame Bonaparte? | |
| 11. Qu'apprit-elle de la petite fille? | |

NOTES.

- | | |
|---|---|
| (a) En, for it. | (f) D'accord, agreed. |
| (b) En me chargeant, in taking upon myself. | (g) From please. |
| (c) Par, a. | (h) Ne se le firent pas répéter, did not wait for a repetition of this. |
| (d) Menus plaisirs, pocket-money. | (i) À terre, on the ground. |
| (e) Ce que tout cela va devenir, what will be the result of all this. | |

SECTION IV.

La cabane contenait à peine quelques meubles¹ indispensables. L'enfant endormi, quoique ses joues fussent pâles² et ses bras maigres, était bien rangé³ dans sa couchette. Sur un mauvais grabat, était étendue⁴ la malade et souffrante, une femme jeune encore, mais dont les traits flétris faisaient peine à voir. La misère de ces pauvres gens toucha profondément le cœur de Madame Bonaparte; rien de pareil encore ne s'était offert à ses regards.

"Vous êtes malade, ma bonne femme," dit Madame Lecititia en s'approchant; "un médecin vous donne-t-il des soins?"

"Ah! Madame, de pauvres gens comme nous ne doivent pas réclamer des soins qu'ils ne peuvent payer."

Pendant ce dialogue, Napoléon s'était approché⁷ de l'enfant qui faisait du fil, et n'avait pas tardé à faire avec lui plus ample connaissance.

Depuis ce temps, la cabane était souvent le but des promenades de Madame Lecititia et de ses enfants.

Jacopo, tel est le nom du fils du pêcheur, s'était surtout concilié les bonnes grâces¹⁰ de Napoléon, qui, sur ses menus plaisirs, trouvait toujours le moyen de mettre quelque chose de côté pour lui. Aussi était-il devenu pour Jacopo l'objet d'une sorte de culte¹¹ et d'adoration; pour Napoléon, Jacopo aurait tout sacrifié¹² jusqu'à sa vie.

Cependant, lorsque Napoléon eut atteint¹³ l'âge de dix ans, il dut¹⁴ quitter Ajaccio. Avant de partir, l'enfant alla faire ses adieux¹⁵ à la famille du pêcheur, et ce ne fut pas sans verser quelques larmes qu'il se sépara de Jacopo. Il avait une très-jolie boîte en ébène, de la grandeur à peu près d'une tabatière, à laquelle il(e) tenait beaucoup; il y grava son nom avec la pointe d'un canif, et¹⁶ en fit cadeau à Jacopo, qui la reçut en sanglotant, et la plaça immédiatement¹⁷ sur son cœur. Jamais ce souvenir ne devait le quitter.

Nous ne suivrons point Napoléon dans les différentes phases de sa prodigieuse fortune.

Le deux décembre mil huit cent cinq, l'armée française était campée dans les plaines d'Ansterlitz. Le soleil se lève; entouré de ses maréchaux, l'Empereur attend, pour donner ses ordres, que l'horizon soit tout à fait éclairci.

"Soldats," s'écria-t-il, "il faut finir cette campagne par un coup de tonnerre!" Et le combat s'engage aux cris de *Vive l'Empereur!*

COLLOQUIAL EXERCISE.

1. Que contenait la cabane?
2. Que dit l'auteur à l'égard de l'enfant endormi?
3. Que voyait-on sur un mauvais grabat?
4. Quel sentiment Madame Lecititia éprouva-t-elle?
5. Que dit-elle en s'approchant?
6. Que répondit la pauvre malade?
7. Qu'avait fait Napoléon pendant ce dialogue?
8. Où Madame Lecititia et les enfants allaient-ils souvent depuis cet instant?
9. Quel était le nom du fils du pêcheur?
10. Avait-il obtenu l'amitié de Napoléon?
11. Qu'était devenu Napoléon pour Jacopo?
12. Qu'aurait fait le petit garçon pour son bienfaiteur?
13. Quand Napoléon dut-il quitter Ajaccio?
14. Qu'alla-t-il faire avant de partir?
15. Qu'avait-il alors?
16. Que fit-il de la boîte?
17. Où Jacopo plaça-t-il le cadeau?
18. Quel jour l'armée française était-elle campée dans les plaines d'Ansterlitz?
19. Qu'attendait l'Empereur?
20. Que dit-il aux soldats?

NOTES.

- (a) Bien rangé, neatly arranged.
(b) Étendue, lying; from étendre.
(c) From atteindre.
(d) Dut, was obliged to; from devoir.
(e) À laquelle il tenait beaucoup, which he valued much.

HISTORIC SKETCHES.—XXXVIII.

THE ITALIAN REPUBLICS.

THE existence of the Italian Republics is one of the most curious facts of the Middle Ages. When it is considered that until a comparatively recent time, republican institutions were nowhere tolerated, and that in what we are pleased to call the Dark Ages the one-will system of despotism was all but universal, it is matter for wonder that in the very centre of the civilised world there should have been suffered to grow up and to flourish states founded upon universal suffrage, institutions which lacked in every particular, even in the matter of order, the elements of public policy which were in common use throughout the known world.

Yet the many independent tiny states which sprang up in Italy about the beginning of the tenth century, and multiplied, replenishing the earth immediately around them, and subduing it until the end of the twelfth century, answered exactly to this description. They were the outcome of decaying princely imperialism, which was not strong enough to crush out their life; they were the vanguard against nascent priestly imperialism, which failed to thrive so long as they stood true to themselves and to the principles on which they were founded.

It may sound strange, but imperial Rome herself was the example by which the republics guided themselves; in this as in many other matters she was the model for the world. After the departure of the emperor and the government to Constantinople (A.D. 334), the Romans, left to themselves, had to improvise a ruling system, and to organise the means of resistance to those external foes who daily threatened to destroy the empire, and who did, in fact, again and again come down in force upon its frontiers and offer violence even to the Eternal City. The Romans accordingly turned back to an old page in their history, and deeming that the republican times were those of greatest past strength and glory, moulded their new government upon the old, and for a while presented the spectacle of democratic institutions in the very cradle of despotism. They were not strong enough, not united enough, to establish themselves *en permanence* on this basis, and in a very short time their bishop, who had been invited to take a share in the government, acquired royal prerogatives in it, and subverted republicanism while retaining the form of it. Whether but for this the Romans would have preserved their independence it is hard to speculate, impossible to say; the German emperors and French kings were too much interested in possessing her, and in winning the prestige which possession of Rome gave to allow her to remain in peaceful enjoyment of independence; but she set the example which was largely followed by cities of less seeming importance than her own—she was the model on which were founded the mediæval Italian Republics.

It may be as well to mention here how Italy came to be under the dominion of the French emperors, a dominion from which she emerged into the republican phase of her existence. After the decline of the Western Roman empire at the end of the fifth century, eight Gothic kings in succession held sway over Italy, but the last of these being expelled in the year 553 by Narses, acting in behalf of the Greek emperor, the southern portion of the peninsula reverted to the imperial rule, while the northern part remained under the kings of Lombardy. Over districts of the recovered south the Greek emperor appointed governors, called exarchs, the chief of whom had his seat of government at Ravenna; and these viceroys held a sort of authoritative place for over a century and a half, the Bishop of Rome having equal authority with them, or rather superior power, for half-savage princes in the north, who paid no attention to, showed no respect for the imperial lieutenants, forbore at the bidding of the Roman bishop to use that violence they did not scruple to show to the arm of flesh that pretended to hold them off. Time, however, wore off the fear which belief or superstition inspired, and Lombard kings began at last to think that ecclesiastical princes were no more to be respected than lay princes, seeing that they combined the secular element with the clerical in a union that admitted of no distinction between themselves and others. About the year A.D. 712, therefore, Luitprand, King of Lombardy, began to turn his attention southward, and was only dissuaded by the strongest solicitations of the Pope from sacking the city of Rome. Forty years afterwards, his descendant, Astolphus, urged by suggestions of conquest, was undeterred even by religious considerations, and was only kept at bay by the intervention of foreign arms. The Greek emperor having been appealed to in vain—the exarchate of Ravenna had already fallen—the Pope applied to the Frankish emperor, the most powerful prince in Western Europe, for assistance. Pepin the Short quickly responded to the invitation, and the mere terror of his threats kept the Lombard hands off. Desiderius, the son of Astolphus, however, relieved by the great monarch's death from the dread of immediate danger, led an army to the south, and intended to acquire for himself the Eternal City. Charlemagne, the successor of Pepin, anxious to obtain for himself recognition as the arbiter in Italy, and solicitous also of acquiring the imperial dignity, listened attentively to the requests from the Pope; and when Desiderius

grew troublesome, and actually set out for Rome, he put himself at the head of a considerable army, and, descending from the Alps, hurled the Lombard back into his kingdom in the north. Charlemagne retiring, Desiderius returned, and once more drew the French emperor from his Trans-alpine seat. Desiderius was overthrown with great loss; the Frankish army marched to Rome, and its leader received from the hands of the grateful Pope the imperial crown, with all the sanction that priesthood in a superstitious age could confer. A similar title had been freely granted to Pepin, but Charlemagne was the first to acquire it to the full extent. Italy passed under Frankish dominion, but Rome, with its bishop, obtained special terms; and the bishop obtained more special terms still for himself being raised to the dignity of a temporal as well as spiritual prince, independently of the Roman people and of the emperor who was supposed to rule over them. For a century this state of things continued, the Popes getting increased power as the power of the emperors declined, till the death of Charles the Fat, when the political confusion mentioned in this article caused the Popes to be left to their own devices, and the supremacy in Northern Italy to be disputed among the satraps of the empire.

When Charles the Fat, last reigning monarch of the house of Charlemagne, died, in the year 888, Italy which was included in his empire, was parcelled out among a few nobles who had gradually arrogated to themselves royal powers. They had taken advantage of the impotence of the last Carolingian kings to carve out for themselves kingdoms over which they ruled with an authority that admitted of no appeal. They paid nominal obedience to the French king, but in reality never heeded the least of his commands. Chief among them were the Dukes of Tuscany and Spoleto, the Marquises of Ivrea, Susa, and Friuli, and the Lord of Benevento. Ten years of internecine war and of striving for the mastery ended in the coronation of Guy, Duke of Spoleto, not as emperor, but as lord over his brethren in the northern part of Italy. Then came war again, bitter and disastrous; there was no one to strike in and to restore order with supreme authority, and in the end there happened what must always happen when co-equals are pitted against one another—a third person was called in, who suppressed the wranglers. In the year 962, Otto the Great, Emperor of Germany, was elected by general assent to take the place for which the Frankish monarchs were proved to be inadequate. He received the allegiance of the West, and conceding to the Pope something more than he had already acquired, won the support of that prelate, while he at the same time assisted to build up the edifice of priestly power that afterwards became so great, overshadowing even the imperial force that made it. Of course the emperor, ruler of so vast a domain as he was called to govern, could not have an equal eye to all his subjects; he was unable to rule in his elective foreign states as in his own home territory, and there was, moreover, in the former an element of disunion which militated strongly against any idea of universal comprehension. There was in the Italian districts, especially in the cities, a spirit of resistance to German domination quite equal to that which has characterised Italians in the present day; there was in the Italian mind a consciousness of superiority which no amount of brute force could overcome; and there was also a determination to make this consciousness apparent in every possible way.

Under these circumstances it was that the Italian Republics, so famous in the history of arts, literature, and commerce, sprang into being, and entered upon a career which was more or less glorious, until selfishness asserting itself, and treachery becoming rampant, reduced them into a final state which was worse than the first. "It is impossible," says Mr. Hallam, "to ascertain the time at which the cities of Lombardy began to assume a republican form of government, or to trace with precision the gradations of their progress." But it may be stated generally that about the end of the tenth century republicanism began to find expression in the cities of Northern Italy. Milan, if not the earliest, was the first important city which made itself independent. It not only maintained itself against imperial tyranny, but repelled (as in the year 991) the insolence of priests by expelling its archbishop. Milan, as the centre of Lombardy, and as the seat of government under the Lombard kings, had a prestige and a vantage point which were lacking to the other cities, and when it came to be a question

of the cities making head against king, emperor, or pope, Milan was naturally looked to as the leader in the struggle, and quite as naturally accepted the post. It was Milan that, in the year 1167, organised the League of Lombardy against the Emperor Frederic Barbarossa, and after suffering enormously from the brutality as much as from the power of his attacks, succeeded in extorting from him, after his overthrow at the battle of Legnano, the Peace of Constance, whereby the cities in the league were maintained in the enjoyment of all the royal rights, whether within their walls or in their district, which they could claim by usage. The right of levying war, of raising fortifications, and of administering justice were specially conferred, together with the right to elect magistrates; while the emperor was allowed to retain one or two privileges which denoted his superiority, and was to receive an oath of allegiance from the cities every ten years. But for jealousies which sprang up in all directions the Lombard cities might have established once and for ever a federal union which would have defied all external powers whatever. Jealousy, however, entered to a most injurious extent, and the result was a never-ending series of wars and rivalries which on several occasions gave emperor, duke, and count an opportunity, of which they availed themselves, to step in and take revenge for past slights.

The great republics, besides the republic of Milan, were those of Genoa, Florence, Pisa, Cremona, Pavia, Parma, Lodi, Alessandria, Verona, Padua, Bologna, Ferrara, and Faenza. Later on, Venice, more famous than any of them, rose into power, but under different circumstances and with different interests. One form of government seems, with slight modification, to have been general to all the earlier republics. By universal suffrage one or more consuls were elected to preside over the council of safety, a sort of ministerial committee chosen by the people and charged with the actual government. The consuls were appointed annually, and were invested with large powers, but were not made absolute except in case of war, when they were in the nature of dictators for the time being. The abuse of power by these rulers, or, perhaps, rather the jealousy of natives, who disliked that one family or one man, where all were equal, should be so greatly in the ascendant, led, about the end of the twelfth century, to the institution of podestas, as they were called, that is to say, governors selected from some one of known eminence in Italy; it might be in the neighbourhood, it might be at the other end of the peninsula. The podesta acted as general, criminal judge, and preserver of the peace. The proper discharge of the duties of this office required a man of no ordinary power, and demanded above all an upright and clear-minded man. It was manifestly difficult for any native citizen to exercise such power; the foreign element was found to be most advantageous as avoiding favouritism, and the danger of tyranny on the part of the podesta was avoided by making his office an elective one, and tenable for a year only. It was the business of the podesta to lead the forces of the republic, to act as general in the field, and as negotiator after the battle. He was more or less absolute.

It is evident that such a power as this was likely to be abused, and in effect there grew out of it those oppressive dominations by powerful families which caused so much jealousy and so much suffering, and which ended in the ruin of the republics. As time went on, men were chosen for podestas who had signalled themselves in some especial manner in respect of some of the special attributes of a dictator, and as war was one of these, it followed that men were chosen who were skilled in the military art. Such men were the commanders of the mercenary foreign troops who made war a trade, and sold their services to the highest bidder. Once elected to fill a civil and military post, these men filled it in a way wholly military, and established a despotism backed by professional force which no citizen power could withstand; *coups d'état* followed, and then hereditary tyranny, till at last the spirit of freedom which erst prompted the foundation of the little states was entirely crushed under a vulgar and mere soldier ruler. Thus the house of Sforza came to rule for years in Milan, and thus other names equally well known in Italian history came into notoriety. In some cities the same thing happened at the hands of native citizens, and men like the Medici at Florence, the Doria of Genoa, the Malatesti of Rimini, and, after the downfall of Sforza, the Visconti of Milan, rose into a power, which was not far short of that enjoyed by princes. Popular government was

of course quite incompatible with this state of things, the people passed under the yoke from which their forefathers escaped, their only satisfaction being that their tyrant was one of themselves and within reach.

All the larger republics held, by treaty or conquest, districts of land and cities apart from their own. Tribute, contributions of men and material were exacted from these, and in war-time they suffered all and more than the hardships borne by the owning republic. Sometimes they were a source of weakness, choosing the time of their master's trouble to pay out some ill will and to requite some oppression; but generally the deterring influence of fear of punishment after the war kept them loyal, in deed at all events. The civil and foreign wars endured by the republics were continuous, and when very bitter, ruinous. This was the case with the wars between Genoa and Venice, until the latter prevailed in what proved to be at once a fatal struggle for Genoa, and one from which the other state emerged stronger than before. In 1378, Venice, which by her wealth and power had excited the cupidity and envy of other republics, drew down the united forces of Genoa, Padua, and Hungary upon her. The Genoese admiral, Doria, blockaded the city with a fleet of which the strength seemed overwhelming; distress made Venice ask terms of peace, which were refused by Genoa; and the ambassadors who went to sue, returned to Venice with the assurance that there should be no peace till the allies had put a curb "in the mouths of those wild horses that stand upon the place of St. Mark." Desperate men do desperate things; and the Venetians, under the conduct of their admiral, Pisani, thereafter attacked the Genoese, and fought so well that they destroyed the enemy's fleet, and compelled the Genoese to fall back upon their allies in order to save themselves from annihilation. From this time Genoa declined in power, and Venice began to acquire it. For the moment, Venice had to make concessions to the King of Hungary and the Lord of Padua; but she grew yearly in strength, and the time came when she reduced Padua to the condition of a dependency, and made the Hungarians anxious to secure her alliance. Long after all the other republics had been overthrown, or absorbed in the territory of some grand duke, Venice remained, for wealth and influence, one of the most important states in Europe. Though shorn of much splendour, stripped of almost all her mainland territory, and no longer the entrepôt for commerce between Europe and the East, she continued to elect her doge or head magistrate every year, and to preserve a kind of independence, until Napoleon Bonaparte executed the threat of the Genoese admiral, and put a bridle in the mouths of the horses of St. Mark. In 1797 the Republic of Venice ceased to exist, and in 1814 was by treaty embodied in the Austrian empire, a disposition which, though familiar enough historically to all the other republics, was as utterly unknown historically as it was uncongenial to Venice. Hence the deep hatred, deeper than in Milan or other Lombard cities, felt by the Venetians for the Tedeschi during the whole period of occupation; hence the delight with which, after the battle of Sadowa, the Venetians found that the restoration of their city to Italian hands was one of the articles in the Austro-Prussian treaty of peace. For the rest, the many other republics to which allusion has been made herein, fell one by one under the authority of a few of the strongest among their brethren; and these again, as the progress of larger kingdoms in the west and north became more marked and their condition more settled, were found to be incompatible with the new order of things, and were accordingly taken to form parts of grand duchies (for the most part under German grand dukes), till these again fell to pieces under the disintegrating Italian policy of Napoleon III., and became, after Magenta and Solferino, part and parcel of the present kingdom of Italy.

LESSONS IN ITALIAN.—IX.

VII.—THE ACCENTS (continued).

2.—THE ACUTE ACCENT

THE acute accent has been adopted by modern authors as the mark to show the difference of meaning in some words of the same spelling, though differently pronounced, which words, without the acute sign, might occasion confusion and ambiguity, particularly in the case where words of more than one syllable terminate in the diphthongs *ia*, *ie*, and *io*, and from the use of the acute sign over the *i*, and the necessary stress laid on the

syllable thus accented, acquire a different signification. But even in words ending in *io* and *ia*, and presenting no ambiguity, the acute sign is not unfrequently placed merely to indicate that the letter *i* does not make the two terminating vowels *o* and *a* in conjunction with the *i* diphthongs, but that they are separate syllables. It is a characteristic of the acute sign that it can never be used in final letters, like the grave accent. But the use of this accent is, generally speaking, not regulated by invariable rules, and is frequently left to the discretion of the writer. The acute sign, which I have adopted in these grammatical instructions, exactly answers the purpose for which it has been introduced by Italian writers, with this difference only, that I shall use it throughout the whole course of the grammar, while they place it merely on some words to avoid ambiguity.

I shall only give a list of words where it is more generally used, some of which I have already quoted in the preceding pronouncing tables.—*Natio* (nah-tec-o), *natia* (nah-tec-ah), natal, native; *restio* (rai-steo-o), restive, stubborn; *stantio* (stahn-tec-o), old, stale, fruitless; *leggio* (led-jec-o), reading-desk, a painter's easel; *ubbia* (oob-bee-ah), bad presage; *malia* (mah-lec-ah), sorcery, enchantment; *bastia* (ba-steec-ah), bastion; *strofinio* (stro-fee-nec-o), scouring, rubbing; *mormorio* (mormo-ree-o), buzzing, murmur; *rovio* (ro-vee-nec-o), great noise; *ficine* (feeo-tchee-nai), skin of raisin-stones; *zúolo* (tsóo-fó-lo), a whistle; *márgine* (márr-jec-nai), scar, edge, margin.

With the Acute Sign.

Balia (bah-lee-ah), power.
Già (jé-ah), he went.
Néi (né-ee), moles, patches.
Ancora (ahn-ko-rah), anchor.
Stropiccio (stro-pit-tchee-o), friction, rubbing.

Without the Acute Sign.

Balia (bah-lee-ah), nurse.
Già (jah), already, indeed.
Néi (nai-co), in the (pl.).
Ancora (ahn-ko-rah), again.
Stropiccio (stro-pit-tcho), I rub.

3. THE CIRCUMFLEX ACCENT.

The circumflex accent is of more recent use, particularly among poets, to distinguish words of the same form, but of different signification; as, for example:—

With the Circumflex Sign.

Torre (tór-rai), to take, seize (for *Torre* (tór-rai), tower.
Córra (kór-rai), to gather (for *Corre* (kór-rai), he runs.
Amáro (ah-máh-ro), they loved (for *Amaro* (ah-máh-ro), bitter.
Féro (fái-ro), they did.
Ora (ó-rah), breeze, zephyr.
Allór (ahl-lór), laurel (for *alloro* or *allori*).
Udir (oo-deér), they heard (for *Udire* (oo-deér-rai), to hear.

Without the Circumflex Sign.

Torre (tór-rai), tower.
Corre (kór-rai), he runs.
Amaro (ah-máh-ro), bitter.
Fero (fè-ro), fierce, wild.
Ora (ó-rah), now.
Allora (ahl-ló-rah), then.
Udire (oo-deér-rai), to hear.

The reader will have remarked that the circumflex *ó* in the above examples has the open sound; and thus this marking of those words on the part of modern Italian authors agrees with the sign that I have uniformly adopted to mark the open or second sound of *o*.

I cannot begin my exposition of the grammar of the language without first offering some remarks on the use of the apostrophe in Italian, which, with the general table, will conclude for the present my lessons on pronunciation. Some supplementary and important pronouncing tables will be given at the end of the grammar.

VIII.—THE APOSTROPHE.

The apostrophe is essentially different from accent, and indicates that the word on which it is placed has been deprived of a vowel or of a syllable. Where, therefore, for the sake of harmony, at the beginning or end of a word, a vowel is omitted because the preceding word terminates with a vowel or the subsequent word begins with one, the apostrophe must be placed. It can never be used in the middle, and all omissions and contractions in the middle of words must be written without this sign. For example: *l' amore* (pronounced lah-mó-rai), love (for *lo amore*); *dell' anima* (del-láh-nec-mah), of the soul (for *della anima*); *dall' uomo* (dahl-looð-mo), from man (for *dallo uomo*); *capo d' opera* (káh-po dō-pai-rah), a masterpiece, an odd man (for *capo di opera*); *s' io posso* (sée-o-pōs-so), if I can (for *se io posso*); *pen's io* (pen-sée-o), I think (for *penso io*); *sopra 'l letto* (sō-prahl-lét-to), upon the bed (for *sopra il letto*); *sotto 'l cielo* (sōt-toit-ché-lo), under the sky (for *sotto il cielo*); *e 'n questo*, *sotto 'l cielo* (en qwaí-sto, en quél-lo), as well in the latter as the former

(for *e in questo, e in quello*); *tra 'l sì e 'l no* (trah see el nó), between yes and no, that is, hesitating (for *tra il sì e il no*).

I may here remark, that the use of the apostrophe at the beginning of a word is more frequently found in poetry than in prose.

It is necessary to bear in mind the distinction between the apostrophe as a sign of elision, and the abbreviation of words where letters are omitted without the use of this sign. I consider it necessary to state some elementary rules with respect to the abbreviation of words.

1. The final vowel of any Italian word may be, and always without the use of the apostrophe, omitted, if it is immediately preceded by one of these four consonants, *l*, *m*, *n*, and *r*, the so-called liquid consonants or liquids, and if, at the same time, the subsequent word should commence with a consonant, except the *s impure*, as the Italians call it; that is, *s* followed by another consonant; as, *spirito*, spirit; *scettro*, sceptre. For example: *il carneval passato* (il kahrr-nai-váhl pahs-sáh-to), the last carnival (for *il carnevale passato*); *a man destra* (ah mahn dē-strah), on the right hand (for *a mano destra*); *ogni uom tacea* (ón-nyee oóm tah-tehí-ah), every man was silent (for *ogni uomo tacea*); *vuol far questo* (voóh fahr kwáí-sto), he wants to do this (for *vuole fare questo*).

2. In words ending with *lo*, and having the accent of tone on the syllable preceding *lo*, it is customary to omit the whole of the syllable *lo*, if the subsequent word begins with a consonant which is not the *s impure*. For example: *bél for bello*, beautiful; *quel for quello*, that, the former; *val for valle*, valley; *cavál for cavallo*, horse; *uccél for uccello*, bird; *fratél for fratello*, brother; *tranquíl for tranquillo*, tranquil; *cervél for cervello*, brains; *ruscél for ruscello*, brook, etc.

3. The abbreviations or omissions of the final vowels mentioned in the two preceding rules can never take place in that part of a sentence which requires a pause, that is, before a comma, colon, or period. It is, therefore, not allowable to say *Ella ha una bella man*, she has a fine hand, but *mano*; not *chi è quel Signor?* who is that gentleman? but *Signore*, etc.

Other important rules with respect to abbreviation I shall state and comment upon as examples occur in the course of the grammar, and I shall now content myself with this concluding remark, that all abbreviations in the Italian language, whether made with or without the apostrophe, are made merely for the sake of harmony and to avoid hiatus, that is, a prolonged opening of the mouth by the recurrence of vowels. But as perspicuity is of greater importance than harmony, this general rule may be safely laid down, that abbreviations should not be used without absolute necessity, and that those should be specially avoided which would tend to ambiguity.

I will here give a general and concluding pronouncing table, showing the most complicated combinations of vowels with consonants of the whole of the Italian language:—

Italian.	Pronounced.	Italian.	Pronounced.
<i>Ca</i> ,	kah.	<i>Glo</i> ,	glo or gló.
<i>Co</i> ,	ko or kó.	<i>Glu</i> ,	gloo.
<i>Cu</i> ,	koo.	<i>Glia</i> ,	liyah.
<i>Ce</i> ,	tchai or tché.	<i>Glie</i> ,	liyai or liyé.
<i>Ci</i> ,	tchee.	<i>Glio</i> ,	liye or liyó.
<i>Che</i> ,	kai or ká.	<i>Gliu</i> ,	liyoo.
<i>Chi</i> ,	kee.	<i>Gna</i> ,	nyyah.
<i>Cia</i> ,	tchah.	<i>Gne</i> ,	nyyai or nnyé.
<i>Cie</i> ,	tchai or tché.	<i>Gni</i> ,	nyyee.
<i>Cio</i> ,	tcho or tchó.	<i>Gno</i> ,	nyyo or nnyó.
<i>Ciu</i> ,	tchoo.	<i>Gnu</i> ,	nyyoo.
<i>Ciaa</i> ,	keenah.	<i>Gua</i> ,	gwah.
<i>Chie</i> ,	keeah or keecé.	<i>Gue</i> ,	gwai or gwé.
<i>Chio</i> ,	keeo or keecó.	<i>Gui</i> ,	gwée.
<i>Chiu</i> ,	keeo.	<i>Guo</i> ,	gwo or gwó.
<i>Ga</i> ,	gah.	<i>Ja</i> ,	yah.
<i>Go</i> ,	go or gó.	<i>Je</i> ,	yai or yé.
<i>Gu</i> ,	goo.	<i>Jo</i> ,	yo or yó.
<i>Ge</i> ,	jai or jé.	<i>Ju</i> ,	yoo.
<i>Gi</i> ,	jee.	<i>Qua</i> ,	kwah.
<i>Ghe</i> ,	ghai or ghá.	<i>Que</i> ,	kwai or kwé.
<i>Ghi</i> ,	ghee.	<i>Qui</i> ,	kwée.
<i>Gia</i> ,	jah.	<i>Quo</i> ,	kwo or kwó.
<i>Gie</i> ,	jai or jé.	<i>Sca</i> ,	skah.
<i>Gio</i> ,	jo or jó.	<i>Scu</i> ,	ska or skó.
<i>Giu</i> ,	joo.	<i>Sci</i> ,	skoo.
<i>Gla</i> ,	glah.	<i>Sce</i> ,	shai or shé.
<i>Gle</i> ,	glai or glé.	<i>Schi</i> ,	shee.
<i>Gli</i> ,	gli or liyee.	<i>Sche</i> ,	shai or shké.

Schi, skee. | *Schia*, | skeeah. || *Scia*, | shah. | *Schie*, | skeeah or skeecé. |
Scie,	shai or shé.	*Schio*,	skeeo or skeecó.
Scio,	sho or shó.	*Schiu*,	skceoo.
Sciaa,	shoo.		

In my next lesson I shall enter on the grammar proper of the Italian language. In fulfilment of my promise to follow the natural method to teach, as it were, the language as it is formed in the mind, I shall first speak of nouns, and other kinds of words allied to nouns, and then proceed to explain the verbs and their various inflections. Two methods are open to choice, each of which has its zealous advocates in tuition. Some would confine themselves strictly to theory in grammatical teaching; others as exclusively to practice in the earlier stages of the instruction. If we adhere strictly to the theoretical exposition, the progress of the pupil is sure, but slow; if we are merely practical, the pace may be rapid, but the attainments are superficial. I shall endeavour to blend the two, and while I, as concisely as I can, explain all the principles and rules of the language, I shall constantly strive to impress them on the minds of my pupil-readers by practical exercises on each rule as it occurs. I shall, in this part of my labour, endeavour to improve on a modern invention of Germany, the country, perhaps, most distinguished for scientific method in education. It should be the aim of every educator so to teach, that his pupils may regard the instruction as relating to a living language to be acquired by the tongue, and not merely as dead writing to be comprehended only by the head. From the very outset of these grammatical lessons my pupils will learn to form sentences, so that as the head acquires knowledge of its principles, the tongue will grow familiar in the practice of the language. In thus uniting practice with theory, I shall, of course, be obliged in one class of the exercises to anticipate the systematic exposition of principles, but I shall only do so with strict regard to the progressive knowledge of the student, and I shall specially adapt the exercises to that end, and perhaps thereby succeed in more firmly impressing even the rules anticipated on the mind. The pupil must bear in mind that he is now about to learn to speak as well as to read the language of Italy.

With regard to the selection of exercises, I shall not scruple, in addition to my own, to make a free use of examples which have passed the test of years of experience in the best schools of Italy and Germany. I am more anxious to serve the interests of my pupils than gratify a literary vanity; and even were I to make an effort at originality, by the preparation of exclusively new exercises, one man could hardly hope to excel the united labours of many grammarians in this direction.

The exercises ought to be read over frequently, and always aloud; and if committed to memory, so much the better for the knowledge of the student.

As I have so very fully explained the elementary principles of pronunciation, even at a length which may have damped the ardour of more impatient readers, it will not henceforth be necessary to give the pronunciation of each Italian word used. Should any doubt occur, the student can always refer to the pronouncing lessons or to the general table which precedes these remarks. As it is, however, most desirable that the reader should have as much assistance as possible, I shall aid him by a new, and, I believe, a most effective method, namely, by dividing each Italian word used into syllables, for the most part, as the words are divided in Italian spelling and writing. I shall not omit to mark the accent of tone with the acute sign or with the circumflex sign over the *e* and *o*; signs, be it remembered, not used in Italian writing or printing, with the exception of the words commented on in my remarks on the use of the accent. The grave accent will, henceforth, always be placed where the usage of writing requires it, and in such cases it will serve, likewise, to denote the accent of tone. I am induced, by three reasons, to adopt this method of dividing words into syllables:—

First, to correct the great fault of Englishmen in pronouncing Italian by slurring over words, the component sounds of which are unfamiliar to the ear. By this means, the learner will be in some measure compelled to do justice to each syllable.

Secondly, it will be a practical aid to the memory. This dwelling on the ingredients of the word will impress the word itself better on the memory.

Thirdly, it will be useful in the case of compound words, in indicating at once the elementary constitution of the words.

MECHANICS.—XIV.

COMPOUND PULLEYS.

We are now in a position more clearly to understand the remaining mechanical powers. We have explained the principle of the simple pulley, and seen how to find out the advantage gained by it, both when the cords are parallel and when they are inclined at an angle. But there are various combinations of fixed and movable pulleys which are called compound pulleys, and are very frequently used in ships and in raising heavy weights, or exerting powerful strains. We must examine the principle of these, and see how to ascertain the advantages gained by using them.

They are usually classed in three systems.

In the first system, which is represented in Fig. 72, each pulley hangs by a separate cord, and all are movable, at least all that have any effect, the runner, D, being introduced merely for the sake of reversing the direction in which the power acts.

Now let us try and see what is the ratio the power bears to the weight when the system is in equilibrium. We will suppose, for the sake of simplicity, that the power applied to P is 1 pound. The strain or tension of the cord P G is the same throughout its entire length (we are not taking into consideration now friction and the imperfect flexibility of the ropes). The pulley C is therefore kept at rest by the tensions of the three cords, G C, D C, and B C, and as these are parallel forces, the strain on B C is equal to the sum of the other two, each of which is 1 pound. The tension of each part of the cord C F is therefore 2 pounds. In the same way we see that the tension of the next cord, B E, is double that of C F, that is, 4 pounds. But the weight, W, is supported by the two cords, B A, A E, or rather by these two parts of

the same cord, and as each has a strain of 4 pounds, the total weight supported is 8 pounds. In this case then, there is a gain of 8, a power of 1 pound balancing a weight of 8 pounds. Similarly, if another pulley were added, a power of 1 pound would balance a weight of 16 pounds, each additional pulley doubling the weight supported; and thus we have the following rule for determining the gain in the first system of pulleys:—

Multiply 2 by itself as many times as there are movable pulleys; the result will show the mechanical gain.

Thus, if there are five pulleys, the gain is $2 \times 2 \times 2 \times 2 \times 2$, that is, 32. You must be careful, in calculating this, not to count the fixed pulley, as that has no effect.

In the second system of pulleys, instead of each having a separate cord, the same one passes round all, and they are arranged in two blocks, one of which is fixed, and the other (usually the lower) is movable. Fig. 73 represents this system. One end of the cord is here fastened to the hook A on the fixed block, and it then passes in succession round the pulleys B, C, D, E, F, and G. In this case, the weight is supported by six folds of the same cord, and each bears an equal part, the cord being equally strained throughout. Each part, therefore, sustains a portion of the weight equal to P, and W is therefore six times as great as P.

If we take away one pulley or sheave, as it is called, from the lower block, leaving two only, the weight will be divided between four folds of the cord, and thus only four times the weight of P will be supported.

Similarly, were we to add another sheave to each block, we should have a mechanical advantage of 8. We see then, that

in this system, the advantage is always twice as great as the number of pulleys in the movable blocks.

We have in this calculation supposed the cords to be parallel. They are not, however, strictly so, still the difference is so slight that we need not notice it. A trifling loss of power, however results from it.

Now there is one disadvantage about this system when made as shown in our illustration, and that is, that the weight must, on account of the length of the blocks in which the pulleys are set, be a long way below the point to which the upper block is fixed. If we are using it, for instance, to strain a telegraph wire or to tighten a rope in the rigging of a ship, purposes for which blocks are constantly employed, we should fasten our rope to the hook from which W hangs, and fasten the fixed block to the "dead eye" on the side of the ship; but then we should not be able to bring the rope within some considerable distance of the eye. Another form of this same system has therefore been contrived which obviates this difficulty. This is shown in Fig. 74.

Here the required number of sheaves, three in the present case, are fixed side by side in each

block, and the cord is fixed to a hook or staple in the upper one, and then passes in succession over each sheave. The weight is, of course, as before, divided between the six ropes. In all these cases it must be remembered that, as the lower block is suspended from the cords, it forms a part of the weight lifted, and the weight W is therefore less by this amount than our calculation makes it appear.

There is a third plan for arranging this system of pulleys which has the advantage of greatly reducing the amount of friction; there being only one sheave to turn on the axis instead of several. This will be understood from Fig. 75. Each sheave is here a compound one, as if several simple sheaves increasing in size were laid on each other. A little attention will show that for every inch the weight is raised 1 inch of cord will pass over the smallest pulley, and as the cord from this to No. 2 must also be shortened an inch, 2 inches will pass over No. 2. In like manner 3 inches must pass over No. 3. Their sizes must therefore be in the proportion of the numbers 1, 2, 3, etc., or else the cord will grate on the pulleys. This is another illustration of our fundamental law; and we see further that, if the weight is to be raised 1 inch, each of the cords supporting it must be shortened by that amount, so that in this case P must fall 6 inches to raise W 1 inch; but a power of 1 pound will balance a weight of 6 pounds; therefore, here also, the power multiplied by the distance through which it moves is equal to the weight multiplied by its distance.

These two systems are those in most general use. We must, however, just look at the third system, which is represented in Fig. 76. B is a pulley fastened to the cord B D, which passes over the runner A, and is made fast to the weight at the other end; C is likewise fixed to a cord which passes over B to the weight; a third cord passes over C, and P acts at the extremity of this. Each cord is thus fastened to the weight. Now in this case it is rather more difficult to find the advantage gained, as the weight is not shared equally by the three cords. The first cord is stretched by P, which, as before, we will call 1 pound; the part C F, therefore, supports 1 pound of the weight. The next cord is stretched by the tension of the two parts of the first, and its strain is therefore 2 pounds, which is the portion of the weight it sustains. Similarly the tension of the cord which passes over the pulley A is 4 pounds, and therefore the entire weight supported by P is the sum of 4, 2, and 1, that is, 7 pounds. Were

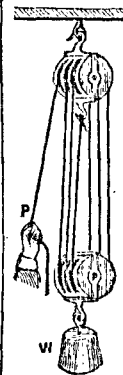


Fig. 74.

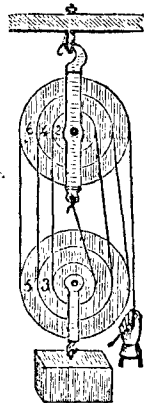


Fig. 75.

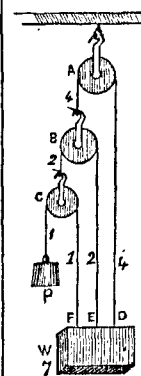


Fig. 76.

LESSONS IN FRENCH.

another pulley added, P would in like manner support $8 + 4 + 2 + 1$, or 15 pounds.

This, then, completes the description of the different systems of pulleys. Try now and work out the following examples of the different mechanical powers as far as we have gone. In mechanics, as well as in everything else, practice makes perfect, and the only way to become fully acquainted with its principles is to try their application to the various cases in which you meet with them. You can easily find plenty of examples to try in addition to those given here.

EXAMPLES.

1. With what force must a man press on a lever, the total length of which is 4 feet 4 inches, in order to raise a weight of 888 pounds, the fulcrum being 4 inches from the end?
2. Two boys are on a see-saw, one weighs 72 pounds, the other 54 pounds; if the plank be 14 feet long, where must the fulcrum be placed for them to balance each other?
3. Three men are weighing an anchor with a capstan. Two have spokes 4 feet long, the third has one 5 feet 6 inches long. The radius of the axle is 6 inches. How much strain do they exert on the cable when each presses with a force of 100 pounds?
4. A man with a winch 18 inches long turns a pinion with 6 teeth, this works in a wheel of 60 teeth, carrying another pinion with 8, which drives a wheel with 54; round the axle of this the cord passes. If the radius of the axle be $4\frac{1}{2}$ inches, what force must be exerted to raise a weight of 2 tons?
- (The radii must here be considered as proportional to the number of teeth.)
5. In the simple pulley (Fig. 69), if the angle $a w b$ is 90 degrees, and the power is 49 pounds, what weight can be supported?
6. In the second system, when there are four movable pulleys, how many pounds must I pull with to overcome a resistance of 7 hundred-weight, and how far must the power move to raise the weight 6 inches?
7. In the third system, with 5 pulleys, what weight will 5 pounds support; and how strong must the middle rope be?
8. If a cask weighing 150 pounds be suspended from a pole 8 feet long, and carried between two men on their shoulders, if the point of suspension be 3 feet from the front man, how much of the weight will each bear?

LESSONS IN FRENCH.—L.

§ 8.—FORMATION OF THE FEMININE OF NOUNS.

(1.) NOUNS referring to persons and animals generally alter their termination in the feminine.

(2.) Many nouns form their feminine by adding *e* to the masculine, whether the latter ends with a consonant or a vowel:—

Masculine.	Feminine.
Voisin, neighbour.	Voisine.
Ours, bear.	Ourse.
Marquis, marquis.	Marquise.
Ami, friend.	Amie.
Mahométan, Mahometan.	Mahométane.
Marchand, merchant.	Marchande.

Note.—The compound noun *nouveau-né*, first-born, has for feminine, *nouveau-née*.

(3.) The following form their feminine by adding *esse*, with or without a modification of the masculine ending:—

Masculine.	Feminine.
Dieu, a god.	Déesse.
Devin, a soothsayer.	Devineresse.
Larron, a thief.	Larronesse.
Pair, a peer.	Pairesse.
Duc, a duke.	Duchesse.

(4.) Nouns ending in *teur* (not deriving from present participles) form their feminine by changing *eur* into *rice*:—

Masculine.	Feminine.
Accusateur, accuser.	Accusatrice.
Bienfaiteur, benefactor.	Bienfaitrice.
Acteur, actor.	Actrice.
Débitteur, debtor.	Débitrice.
Tuteur, guardian.	Tutrice.
Conducteur, conductor.	Conductrice.

(5.) Nouns ending in *eur*, derived from present participles, form their feminine by changing *r* into *se*:—

* This word is not derived from the present participle *débitant*, but from the Latin noun *debitor*.

Present Participle.	Masculine.	Feminine.
Chantant,	Chanteur, singer.	Chanteuse.
Chassant,	Chasseur, hunter.	Chasseuse.
Polissant,	Polisseur, polisher.	Polisseuse.
Débitant,	Débitteur, news-monger.	Débiteuse.
Demandant,	Demandeur, one who often asks.	Demandeuse.
Vendant,	Vendeur, seller.	Vendeuse.
Devinant,	Devineur, one who guesses.	Devineuse.

(6.) Nouns ending in *x* form their feminine by changing *x* into *s* and adding *e*; those ending in *f* change it into *v* and add *e*:—

Masculine.	Feminine.
Époux, husband.	Épouse.
Veuf, widower.	Veuve.
Chartreux, Carthusian.	Chartreuse.
Gueux, wretch.	Gueuse.

(7.) Nouns ending in *en*, *et*, *on*, *ot*, double the last consonant, and add *e*:—

Masculine.	Feminine.
Parisien, Parisian.	Parisienne.
Chien, dog.	Chienne.
Sujet, subject.	Sujette.
Vigneron, vine-dresser.	Vigneronne.
Lion, lion.	Lionne.
Sot, fool.	Sotte.

(8.) Others form their feminine by adding to the masculine either *e* mute or a syllable ending in *e* mute, with or without the dropping of the whole or a part of the masculine termination:—

Masculine.	Feminine.
Czar, Czar.	Czarine.
Héros, hero.	Héroïne.
Sylphe, sylph.	Sylphide.
Doge, doge.	Dogaresse.
Compagnon, companion.	Compagne.
Vieillard, old man.	Vieille.
Cochon, pig.	Cochon.
Canard, drake.	Cane.
Poulin, colt.	Pouliche.
Taureau, bull.	Taure.
Mulet, mule.	Mule.
Loup, wolf.	Louve.

(9.) Many have different forms for the masculine and the feminine:—

Masculine.	Feminine.
Père, father.	Mère.
Frère, brother.	Sœur.
Oncle, uncle.	Tante.
Gouverneur, governor.	Gouvernante.
Cheval, horse.	Jument.
Empereur, Emperor.	Impératrice.
Ambassadeur, ambassador.	Ambassadrice.
Roi, King.	Reine.
Serviteur, servant.	Servante.
Éléphant, ram.	Brebis.

(10.) Nouns expressing professions and trades generally carried on by men have no feminine:—

Graveur, engraver.	Peintre, painter.	Médecin, physician.
Sculpteur, sculptor.	Écrivain, writer.	Poète, poet.
Imprimeur, printer.	Docteur, doctor.	Auteur, author, etc.

(11.) *Témoin*, witness; *adversaire*, adversary; *imposteur*, impostor; *artisan*, artisan; and *partisan*, partisan; have no feminine either.

When the nouns mentioned above (10-11) are used in reference to females, the words depending upon them remain in the masculine:—

Cette dame est un bon peintre, un poète fameux, un écrivain connu. Cette femme est un imposteur, un faux témoin. La princesse était pour lui un adversaire gênant.

(12.) Some nouns referring to animals have only one gender, either masculine or feminine:—

Masculine.	Feminine.
Castor, beaver.	Girafe, giraffe.
Fennec, squirrel.	Panthère, panther.
Éléphant, elephant.	Hyène, hyena.
Crocodile, crocodile.	Souris, mouse.
Vautour, vulture, etc.	Ferdrix, partridge, etc.

To such nouns the word *mâle* or *femelle* is added when it is necessary to mention the gender:—*un éléphant femelle*; *une girafe mâle*.

EXCEPTIONS TO THE RULES GIVEN ABOVE.

(1.) Many nouns ending in *e* do not change in the feminine (see Rule 1):—

Masculine.	Feminine.
Un Russe, a Russian.	Une Russe.
Un artiste, an artist.	Une artiste.
Un camarade, a comrade.	Une camarade.
Un élève, a pupil.	Une élève.
Un compatriote, a compatriot.	Une compatriote.
Un esclave, a slave.	Une esclave.
Un pupille, a ward.	Une pupille.
Un pensionnaire, a boarder.	Une pensionnaire.
Un malade, a sick man.	Une malade.
Un locataire, a tenant.	Une locataire.

(2.) However, the following which end in *é* or in *e*, add *se* in the feminine:—

Masculine.	Feminine.
Abbé, abbot.	Abbesse.
Âne, ass.	Ânesse.
Chanoine, canon.	Chanoinesse.
Comte, earl, count.	Comtesse.
Druide, druid.	Druidesse.
Hôte, host, guest.	Hôtesse.
Maître, master.	Maîtresse.
Nègre, negro.	Nègresse.
Prêtre, priest.	Prêtresse.
Prince, prince.	Princesse.
Prophète, prophet.	Prophétresse.
Suisse, a Swiss.	Suisse.
Tigre, tiger.	Tigresse.
Traître, traitor.	Traîtresse.

and poète, poet, which has a feminine, poétesse, that is rarely used (see Rules 10, 11).

(3.) Paysan, peasant, and chat, cat, form their feminine by doubling the last consonant and adding *e*: Paysanne, chatte (see Rule 2).

(4.) The following, although derived from present participles, form their feminine by changing *eur* into *rice* and *eresse* (see Rule 5):—

Masculine.	Feminine.
Exécuteur, executor.	Exécutrice.
Inspecteur, inspector.	Inspectrice.
Inventeur, inventor.	Inventrice.
Persécuteur, persecutor.	Persécutrice.
Enchanteur, enchanter.	Enchanteresse.
Pêcheur, sinner.	Pêcheresse.
Vengeur, avenger.	Vengeresse.
N.B.—The four following are law terms:—	
Baillieur, lessor.	Bailleresse.
Défendeur, defendant.	Défenderesse.
Demandeur, plaintiff.	Demanderesse.
Vendeur, vendor.	Venderesse.

(5.) Chasseur, hunter, has another feminine, chasserresse, which is only used in poetry; and chanteur, singer, has also a second feminine, cantatrice, which is applied to eminent professional singers (see Rule 5).

(6.) The feminine of bailli, bailiff, which was formerly spelt baillif, is accordingly baillive (see Rule 6).

(7.) The nouns bigot, bigot; cagot, hypocrite; dévot, devotee; idiot, idiot, form their feminine regularly, i.e., by adding *e*:—Bigote, cagote, dévote, idiote (see Rule 7).

LESSONS IN MUSIC.—XX.

ORGANS OF THE HUMAN VOICE—PITCH—QUALITY—STRENGTH—FORCE, ETC.

We propose to collect together in this lesson a large amount of information on the subjects of the different kinds of voices, singing in "parts," and good enunciation. We must refer our readers for fuller information on these topics to Müller's "Physiology," Power's "Human Physiology," Dr. Bristowe's Essay on the "Throat, Voice, and Speech," in the "Book of Health,"

Sir Charles Bell's article on the voice in the "Philosophical Transactions" for the year 1832; and works on the Human Voice, by Dr. Rush, Dr. Lennox Browne, and others.

The CHIEF INSTRUMENT of voice is the larynx, which we may feel with the hand outside, as a little lump, in the upper part of our throats, moving with almost every utterance of voice. It is a small box placed at the top of the trachea or windpipe. Its walls are of cartilage or gristle. Its upper opening is protected by a little valve, called the epiglottis, which falls back upon it in every act of swallowing. At the lower opening are two elastic membranes, one depending from each side, which can be stretched to any degree of tension required, and can be made to meet each other (closing the lower opening) through their whole length, or through any part of it. Various muscles, attached to the walls of the larynx, in obedience to nervous action and the mind's will, regulate these movements.

These elastic membranes, sometimes called the vocal chords, are the source of voice. During ordinary breathing they rest, relaxed, against the walls of the larynx, but in the production of voice they are brought into such a position as to vibrate freely in the air, as it ascends from the lungs (much like the tongue of any reed-instrument), and this vibration makes the breath vocal.

The voice of one individual differs from that of others in PITCH, in quality or TIMBRE, as the French call it, and in power or STRENGTH.

The PITCH of a sound depends on the degree of tension given to the vocal membranes, and on the length of the parts which are left free to vibrate—just as in the harp, violin, and guitar. In females and boys, whose voices are naturally higher than those of men, the larynx is placed higher in the throat, and is also smaller, so as to make the vibrating membranes shorter. When a boy's voice "breaks," the larynx gradually takes a lower place in the throat, and also enlarges in size, so that the voice necessarily becomes about an octave deeper. Müller states that the vocal membrane in the male is half as long again as in the female—as three to two. To produce a given note (say *D* below the treble staff), the male voice, especially if a bass, would require strong tension of the vocal membranes, but the female voice would produce the same note with very little tension, because its vocal membranes are shorter.

The TIMBRE, or quality of a note (which is so different in individuals), is much affected by the form of the air-passages above the larynx. Thus we are sometimes able to imitate the voice of another person, not only in reference to its peculiarities of pitch and inflection by movements of the larynx, but even in its "timbre" by certain conformations of the mouth. It is this difference of shape in the resonating tube which makes the difference between well-known bass instruments of the same length, and yielding sounds of the same pitch, as between the thick euphonium and the thin baritone, and between the thick sax-horn and the thin trumpet. The discoveries of Professor Helmholtz have thrown much light on this subject of timbre or quality of tone. By altering the shape of the mouth you can produce the *sombre* and *clear* resonances of which Garcia speaks.

The general STRENGTH of a voice appears to depend upon the vibrating power of the vocal membranes, the size of the organ, and the capacity of the chest. We know how easily a slight inflammation, or other affection of the mucous membrane lining the larynx, weakens the voice. The voices of old persons are made tremulous by the loss of nervous and muscular power.

The special FORCE or loudness given to an accented note may be occasioned, Müller thinks, by relaxing the tension of the vocal membranes while we increase the force of the air-current. Sir Charles Bell speaks of the back of the mouth and the veil of the palate (the soft palate) as playing a most important part in giving the delicate impulses of accent.

Correct tune requires a mental effort. "Man," says Müller, "like the singing bird, learns unconsciously the different internal changes in the state of the larynx, and the different muscular actions necessary for each note. Sounds accidentally uttered, and the muscular actions which accompany them, become associated in the sensorium, and afterwards readily excite each other when a melody is to be imitated." Correct tune, therefore, depends upon the skill with which the sound is perceived and its "idea" retained, and upon the accuracy with which the mind can command and combine the various muscular movements

necessary for its production. Hence it may be easily understood how the voice will flatten when, from inattention or weariness, the singer does not give prompt and firm tension to the proper muscles of the larynx or chest. The loud singer is especially liable to this, because, as noticed above, his notes are made to depend less upon the easily-governed tension of the vocal chords, and more upon the regulated force of air from the chest—the muscles of which are less easily commanded with accuracy. Hence the importance of cultivating a *medium force of voice*, such as is consistent with the easy action of the lungs.

The VOICES OF WOMEN AND CHILDREN are, on an average, about eight notes higher than those of men. They are very various in character, but may be conveniently classified according to their "compass," or the extent of notes which they can reach on the standard scale.

a. The First Soprano Voice has its extreme compass from *E*² (above the staff) down to *B*₁ (below the staff). Its easy compass is from *A*¹ down to *C*. It is weak in the lower sounds, but light and brilliant (if well developed) in the higher ones above *B*. The organ has not much muscular strength, and cannot easily give effect to sustained sounds, but is very flexible.

b. The Second Soprano Voice reaches, in its extreme compass, from *C*² down to *G*₁. Its easy compass is from *F*¹ down to *A*₁. It is generally full and round in its quality, and flexible. The organ is of a stronger muscular construction.

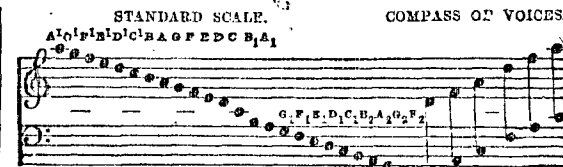
c. The Contra-Alto Voice sometimes reaches from *B*¹ flat down to *E*₁. Its easy compass is from *D*¹ to *F*₁. Its organ is large, and of a very strong muscular construction. It is not very flexible. The upper sounds are harsh or weak. It is, however, sometimes full from *D*¹ down to *G*. It is most powerful from *G* to *G*₁.

The VOICES OF MEN are classified as follows:—

a. The Tenor Voice is of two sorts. The first is that very delicate, light, and rare voice for which the "alto" part was written by Handel and writers of a much more recent period. Like the first soprano voice, among females, it is not adapted to sustained sounds. Its compass is about a tone higher than that of the common tenor voice. The stronger tenor voice has for its extreme compass from *B* flat down to *B*₂ flat (in the bass cleff). Its easy compass is from *A* down to *C*₁. It is full, round, and capable of sustaining and expanding sounds with firmness. Great care should be taken not to force the higher sounds. They should be sustained firmly though lightly, changing into the thin, light register between *E* and *F* or thereabouts. The thick or chest register should never be forced up.

b. The Baritone Voice has its extreme compass from *G* to *F*₂ sharp (below the bass cleff). Its easy compass is from *F* down to *C*₁. It partakes in some degree of the quality of both bass and tenor. It is more soft and flexible than the former. From the case with which it takes the notes *D* *E* *F* (treble cleff), it may sometimes be taken for the tenor. But from the different position of the organ in the throat, these sounds, instead of being full, will be of a hollow quality—being the extreme sounds of the baritone, whilst they are in the middle and fullest part of the tenor. If the voice is at all strained on this part, instead of gaining the soft and full baritone quality, it will become an imperfect mixture of the baritone and tenor.

c. The Bass Voice reaches its extreme sounds in *E* (on the lowest line of the treble cleff) and *E*₂ (below the bass cleff). Its easy compass is from *D* down to *F*₂. It is naturally of a hard and inflexible quality, but very full and powerful in sustaining sounds. Those who understand the old notation will like to see the following diagram:—



The statement of the extreme compass of voices, and some of the remarks on the different voices, are either condensed or extracted from the "Art of Singing," by D. Crevelli, a work which is "the result of study and experience for nearly thirty years" of a gentleman, who was the most successful vocal teacher of his time in England.

It should be noticed that boys' voices, especially for some time before they begin to break, are of a different timbre from those of girls—they are heavier and less flexible.

The term REGISTER is used to denote a certain number of sounds in a voice, which differ in quality or timbre from another number of sounds in the same voice. This change of register is probably occasioned by some difference in the manner in which the notes are produced. It may be that the lower notes are successively produced by somewhat relaxed membranes, which are shortened as the notes rise, and that notes of the higher register are produced mainly by the tension of the membranes without any shortening of the chords. If so, there will be a note or two, at the junction of the registers, which may be produced on either principle, and an un cultivated voice may not decide with sufficient promptitude which principle is to be used, or on which note the new register should begin. This would account for the great difficulty, which many have, in making the notes of one register follow smoothly with those of the other. Such persons require considerable practice and care to "blend" the registers. They should be instructed to keep the notes of the lower register down in strength or force, while they seek to strengthen those of the higher one.

All the tones of the voice are really produced in the larynx, or "Adam's apple," but in producing the strong vibrating lower tones of the voice, the singer feels as though his chest were called to a special effort. In producing other more weak and soft tones, he feels that the back part of the throat is exerting its muscles; and in producing certain clear, ringing tones, beyond the range of his ordinary voice, he is conscious of vibration in the head. Hence the names of the three registers—the chest register, the throat (sometimes called the medium, sometimes the falsetto) register, and the head (also sometimes called the falsetto) register. Each register has its peculiar quality of tone, and is produced by a peculiar management of the vocal organs. On this last point, recent discoveries have confirmed the conjectures of the Italian, Bannati. Müller shows that the throat register of tones is produced by the vibration of the thin borders only of the vocal membranes, while for the chest register those membranes vibrate in their whole breadth. For the head tones it is believed that a third part (in length) only of the membranes vibrates.

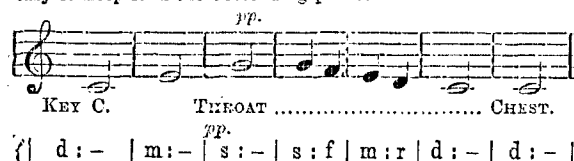
More recently still, the invention of the laryngoscope, and its skilful use by Garcia, and others, have given us many details of the manner in which tones are produced. From these it appears that above a certain place in absolute pitch, the capabilities of tension in the material called flesh and muscle require that tones should be most easily produced in the manner above ascribed to the throat register, and below that pitch in the manner of the chest register.

The place in pitch thus referred to lies between *D* below the treble staff, and *G* on its second line—a point only just reached by the basses, and very little exceeded by the baritones; having above it one-third of the tenor voice, half the contralto, two-thirds of the second soprano, and nearly all the first soprano.

Many of the tones of the chest register could also be produced in the throat register, and vice versa. But the head register of tones never coincides—is never changeable—with the tones of the other registers. Where the throat tones cease, the head tones begin. The chest tones are naturally preferred by the lower voices (bass and contralto), and fill nearly the whole of the bass compass. They are less used by tenors and baritones, and still less by the first and second sopranos. The throat tones are preferred by the sopranos, and form the chief part of their

voices. The tenors and baritones use them in the higher parts of their voices. A baritone wishing to sing a tenor "part," must necessarily have recourse to his softer throat voice, else he will produce *hard, wiry* tones, very unpleasant when contrasted with the soft, round chest tones of the tenor voice. The same remark applies to second sopranos singing the air or soprano "part." Conductors of choirs should be exceedingly careful in this matter, if they would secure a good blending of the vocal mass.

The head tones are exclusively used by the sopranos. In men—all authorities agree—these head tones are effeminate and disagreeable. Garcia says that the head register is not improved by much exercise. Nearly all men *speak* in the chest voice. Nearly all women, including the contraltos, speak in the throat voice; and the *cries* of women and children are in the head voice. Teachers should be warned against allowing boys' voices to be forced upwards in the chest register. Garcia says that this often occasions the loss of voice in chorus children. At "the change of voice" in boys, their voices should have entire rest, often for a full year. Many voices, says Bassini, are irretrievably ruined by the neglect of this precaution. Bassini recommends the following *test* exercise to tenors, baritones, and contraltos, for the discovery of the throat register. The third tone, sung *piano*, is almost sure to be delivered with the throat voice. Then, having once found that register, it is easy to keep it in the descending phrase.



Use of the Registers.—As the registers produce different qualities of tone, it is better, when you have commenced a musical phrase in one register, to conclude it in the same. If this is not possible, then care should be taken, in passing from one register to the other, to maintain regularity in volume of tone. Bassini's rule is, in *ascending* phrases, when you have begun with the chest register, *keep it*; in *descending* phrases, *keep the throat register*.

The voices of women and children are commonly called "treble voices." The highest female voice is often called simply "soprano," and the second voice is then called the "mezzo soprano." The "part" adapted to the second soprano or contralto is sometimes called the "seconds." The "alto" is a very high man's voice, reaching very nearly to the lowest of women's voices, which is called, on that account, the contralto. But the two voices differ greatly in character—the one being light and flexible, the other not so.

Every pupil should mark the extent of his own voice on the scale above given at the side of the page.

The pupils need scarcely be warned against the common foolishness of boasting "how high they can sing." Let them remember that God has made their voices differently; that it is the honour of some to sing the lower parts for which their voices were made, as it is of others to sing the higher parts; and that the *medium* sounds of every voice are not only its easiest, but its *very best*.

Vocal music is commonly so written that several melodies may be sung together—each melody being adapted, in its compass, to one particular voice. The leading (or most striking) melody is almost invariably, and very properly, that which is sung by the highest voice. Each of these concurring melodies is called a "part;" the highest is commonly called the "air."

Those who sing in parts should seek to *attune* their voices one to the other, and to maintain the several parts with an *equal volume* of voice, so that one part may not overpower the others. Each singer should also take care to sing the part proper to his own voice.

We have music "in two parts," written for soprano and contralto voices, or for tenor and bass (like the exercises in this work), or for soprano and bass; music "in three parts," written for three equal voices" (that is, for three female or three male voices), or for soprano, contralto, and baritone, or for soprano, tenor, or bass, etc.; music "in four parts," for

soprano, contralto, tenor, and bass, etc. (like most psalm tunes); also music in five, six, and eight parts.

There is no harmony more perfect than the "concord" of sweet voices. "All musicians knew," says General Thompson, "that by practising together, and, as it were, mutually rubbing down each other's asperities and defects, a quartett of performers on instruments of the viol kind arrived at a perfection of execution in point of harmony, or what is popularly called 'being in tune,' which nothing could excel, and no known thing, *except a quartett of singers*, equal. In short, there was no doubt that by following the directions of the ear as to what was most harmonious, and each labouring to accommodate the other with this common object in view, they did practically break in upon the thing so much sought for under the title of correct harmony. . . . But nobody could tell what it was they did." The General then shows that the thing they did was—to sing or play notes which were mathematically correct according to the scale which the human ear requires—to free themselves from the temperament of keyed instruments—and to observe the double form of RAY which he calls its "duplicité." Let the singer make full use of the advantage he thus possesses.

The "balancing" of parts is important. For a congregation containing every kind of voice, music in four parts—soprano, contralto, tenor, and bass—is most appropriate. The second soprano and the baritone voices, in such music, would have to join with the parts above or below according to convenience. But in the Sabbath-school, where the immense preponderance of voice is that of females and children, to divide the voice of the male teachers into bass and tenor would make them out of all proportion weak. A far better distribution and more equal volume of voice is obtained by using music written in three parts—two for the voices of females and children, and one (of medium compass) for the united voices of the men. A similar proportion is desirable for boys' schools with a master, but the parts should be so written that the two upper melodies may be harmonious when the bass is absent. In girls' schools music in two parts is desirable. If, for Sabbath-schools, the two men's parts are retained, they should be very simple and "steady," sounding rather like an *accompaniment* than like "parts."

After these explanations, it is scarcely necessary to warn the pupil against the absurd practice of women attempting to sing the tenor, or that of males sully, with their tenor or baritone voices, the purity and brightness of the "air." If men are obliged to *pitch* the air of a tune, let them do so; but let them leave the women "to sing it, while they return to the part which is proper to their own voices."

In "*leading*" a tune, it is advisable first to let all the school or congregation distinctly hear the key-note. If necessary, the first note or two (not more) may be sung by the leader in the "air." The leader should then take his own part. He will find himself able to keep up the *pitch* or the *rate of movement* much better by means of a *firm bass* or a *clear tenor*, both well accented, than by singing the air, however loudly or however angrily. When a "clerk" or "precentor" will sing the "air," it takes the spirit from the female voices; but if, perchance, for a line, he leaves them to themselves, they seem to rise with new vigour, sweetness, and brilliancy.

A good enunciation of words is most important to the singer. He cannot use that accent and inflection on each word which so much help us to distinguish the words of the *speaker*, however badly uttered. It is therefore the more necessary for the singer, if he would be "intelligible and edifying," to use an articulation strong, distinct, and correct. Care should be taken to make the *vowel* sounds most *clear* and *accurate*, and to deliver the *consonants* both *quickly* and *forcibly*.

For this purpose, the words should be read aloud by the teacher, so as to show the feeling and proper expression belonging to them, and to exhibit a "pattern" of good utterance. This the class should imitate, in one voice, taking the teacher's pattern line by line. The practice of reading together in a loud whisper will be found very conducive to the end sought.

It will sometimes be convenient to shorten a note when it falls on an ill-sounding syllable, and sometimes to throw the sound of a final consonant on to the following word.

If we were to pursue this important subject further, we should be tempted into a course of lessons on elocution, which would be beyond our province here.

(The Exercises attached to this Lesson will be given in our next.)

RECREATIVE NATURAL HISTORY.

THE DEER FAMILY.

A HISTORY of field sports would be as instructive as amusing. It must inevitably develop both the evil and the good of human nature, showing much courage and daring associated with no little selfishness and cruelty. Hunting would, beyond doubt, take up the greater portion of such a work, from the chase of the lion or tiger to the rather inglorious pursuit of a hare. The chapter devoted to the various field sports of the United Kingdom would first treat of the stag-hunt before condescending to notice the bold fox-hunter or the skilful manager of harriers.

Our present object is not, however, to write a treatise on hunting, but to give some account of an important family of animals which have in all ages been the special objects of the hunter's craft.

This being our third paper on the Ruminants, no special remarks on this order of mammalia are required. It may be sufficient to call attention to the fact that all the *Cervide*, or deer family, have solid horns, a marked distinction between them and the ox, sheep, and antelopes. The deer alone, of all the Ruminants, shed their horns yearly, a physiological change of sufficient importance to give the animals a prominence in natural history.

Some brief descriptions of the more remarkable species are necessary before we examine into the growth and structure of the horns and other peculiar organs.

The species of the so-called Irish elk is now extinct, though some writers assert that individuals existed up to the middle of the sixteenth century. The bones of this gigantic deer are frequently found in the bogs of Ireland

and in the Isle of Man. A perfect skeleton is in the Museum of the Royal Dublin Society, and the spread of the vast antlers, no less than six feet, may give some notion of the magnificent power of this stag when living. Mr. Mantell possessed a pair of horns which extended "thirteen feet from tip to tip." Can the reader picture to himself a deer, six feet high and nine feet in length, carrying aloft such a forest of spreading antlers? The animal is improperly called an elk, the form of the horns proving it to be closely allied to our elegant fallow-deer.

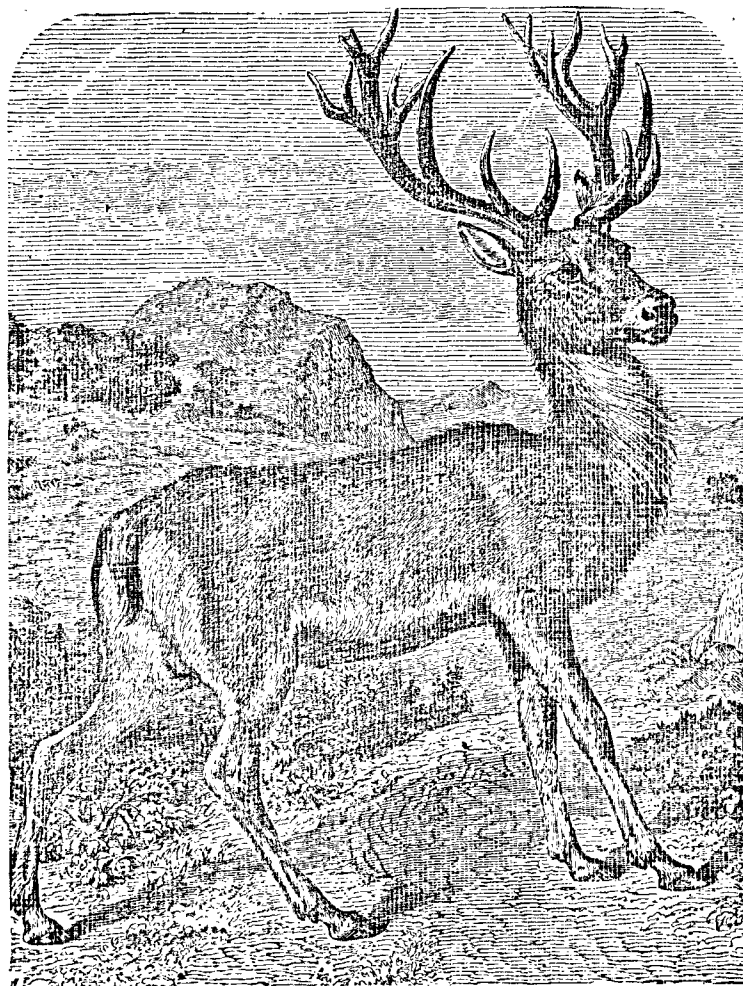
The best living example of the *true elks* is the moose-deer (*Alces Americanus*) of North America. The noble horns of this species expand towards the summit in a manner somewhat resembling those of the fallow-deer, but without antlers at the base or in the middle of the stem. The great weight of these head-weapons, often about fifty pounds, compels the elk to hold

up its head when running, so as to throw the heavy mass backwards over the neck. The great length of the legs, the height of the shoulders, the heavy, shambling trot, huge size of the animal, sometimes seven feet high, and the odd snapping sound of the joints, give to the motions of this deer a peculiar awkwardness. The moose spreads far over the northern regions of America, pushing its journeys, at some points, within the Arctic circle, and offering, in the depth of winter, a splendid prize to the Indian hunter. The elks of Norway and Sweden differ but little, if at all, from the moose; but they are rapidly diminishing in number before the rifles of enterprising sportsmen. Even deer-stalking in the Scottish Highlands must yield

to stalking the elk in the grand solitudes of the Norwegian mountains.

It may be supposed that fable has left these deer alone. Not so: the men of old times were too fond of the marvellous for that. It was believed that the legs of the elk were without joints; that antlers grew from the eyelids; and that the animal was forced to walk backwards as it fed. The very pedigree of the creature was involved in mystery. It was said to be descended from the camel and the deer; thus being, in fact, a most wonderful mule. Such an animal could not be allowed to live a very happy life; it was therefore made subject to severe epileptic fits, which were constantly bringing its tall form to the ground. No wonder, then, that the old Germans named the animal "Flend," or the wretched one! Amidst all those calamities, one comfort remained; the elk always had its medicine at hand. When prostrated by a fit, the patient had only to smell or lick its hoofs to ensure a speedy recovery.

The *Rein-deer* cannot be entirely passed over by us, though it has been so often described that we shall be pardoned for not entering largely into minute details. We must also be excused for declining to discuss the much-disputed mode of spelling this deer's name, whether *Rhen-deer*, *Rain-deer*, or *Rein-deer*, leaving that important matter to the taste of each reader. The various Indian and Esquimaux names are too many for enumeration, amounting to a dozen at least. It is also a question whether the rein-deer, or *Caribou*, of North America is not a different species from that of the Laplanders. The two are, probably, only *varieties* of the same species. No inference can be justly drawn from the diversities in the horns, for in no animals are these variations so numerous as among the rein-deer; indeed, it has been said that it is difficult to find two individuals with horns exactly alike. The American rein-deer was probably called *Caribou* (*Carré-bouf*) by the early



THE RED DEER, OR TRUE STAG (*Cervus Elaphus*).

French settlers in Canada, from the resemblance which the massive body bears to that of the ox.

The size of the animal varies much; the Norwegian are the smallest, and those of Lapland are far inferior to the deer which frequent the polar regions of America and Asia. This quadruped is indeed well fitted to flourish in the lands of snow and tempests. The thick hair defends the body from the most piercing cold, while the hard end of the muzzle and the iron-like hoofs are admirably adapted for removing the frozen snow which covers the white lichens, the favourite food of the animal. These cryptogamous vegetables, which in England rank with the smallest forms of botanical life, and only serve to give a rich tinting to old walls and the trunks of ancient trees, grow luxuriantly on the mountains of Lapland, and cover the barren-ground regions of North America. Among them is the well-known, though wrongly named, Iceland moss, so frequently used by consumptive invalids in England. This is really a lichen, the *Citraria Islandica*. The rein-deer sometimes perish from inability to obtain a supply of this food, and terrible then is the condition of the Esquimaux and Laplander. These famines occur when, instead of snow, an impenetrable pavement of thick ice covers the lichen districts, defying all the attempts of the deer to remove the fatal covering.

In the American regions where these animals abound, they form the chief support of the Indians and Esquimaux, who pitilessly and recklessly slaughter vast multitudes in autumn, when the fat herds are migrating from their summer homes. Many readers may know what *pemmican* is, others may never have even heard the word. It is simply deer's flesh cut small, packed tightly into a skin, and an abundance of melted fat poured into and over the whole, to keep the food from the air, and to give a due richness and flavour to the preserved meat.

These destructive huntings of the rein-deer only happen among the wild and wandering Indian tribes of America. The Laplander knows too well the value of the animals, and preserves the providers of his food and clothing with all care. With two or three hundred deer, and a well-situated lichen tract, he cares little for the rise and fall of the foreign food markets, and still less, if that be possible, for the rise and fall of kingdoms. He wants neither railways nor thorough-bred horses; his trained deer can bear him, if necessary, over the glistening snow-tracks at a rate equal to the speed of the swiftest horse. His daughters' marriage portions and the estates of his sons are to be found in his antlered flock. If he wants a winter coat, the rein-deer skin will defy a frost capable of freezing the mercury in the barometer. Is the Laplander an epicure, he has but to order a dish of deer's tongue, properly cooked by his wife or eldest daughter, when he will have a dinner which is both savoury and nutritious.

The horns are five or six feet long, flattened at the upper parts, and having antlers projecting from the base of each horn in front, and also antlers springing from the middle of the "beam" or horn-shaft, and directed backwards. Thus the whole mass may be divided into four parts: the beam, the base or lower antlers, the middle antlers, and the wide-spreading palmed summit. We must not forget that the female of this species is horned.

The *Musk-deer* demands a few words, before proceeding to notice our native species. We admit that this animal can scarcely be ranked with the deer family; but as popular zoology places them here, and scientific naturalists are unable to class the *Moschidæ* (musk animals) satisfactorily, we shall here regard them as a peculiar species of hornless, but tusked, deer. The true musk animal is found in the high and bleak regions of Tibet; it is about three feet high, and of a pale yellow tint. The musk is a thick brownish fluid, contained in a fleshy bag about the size of a hen's egg, situated on the abdomen of the animal. The dried musk in each bag averages about one-third of an ounce, and is worth a sovereign in the market. As 5,000 are sometimes imported in a single year, this involves the destruction of 15,000 animals. The odour of the new musk is so powerful that the dealers are forced to cover their nostrils with thick cloths while inspecting the bags or "pods." This extraordinary perfume is said to retain all its energetic pungency after exposure to the air for a hundred years. It has proved a puzzle to the analytical chemists, who, after detecting ten elements in its composition, are unable to explain the nature of the perfume.

Let us now give a little attention to our native species, the Red Deer, the Roebuck, and the Fallow Deer of our parks.

The *Red Deer*, or true stags (*Cervus elaphus*), are still wild in Scotland, where they give the "stalker" many an opportunity for testing the strength of his muscles and the steadiness of his nerves. The horns of this species are conical, with antlers springing from the bottom and middle of the "beam." They have none of those expanded surfaces which characterise the elks, rein-deer, and fallow-deer. Every part of these formidable weapons has its appropriate name: the main stem is the *beam*; the great branches springing from this are the *antlers*; the projections near the top are the *branches*; and those at the tip of the beam are called the *sub-royal*, or *crown*. The antlers themselves have distinct names: the first being called the *brow antler*, the second the *bez-antler*, and the third the *royal*. The bony ring at the bottom of the beam is known as the *burr*, of which we shall have something to say. The whole of this horn-system is not produced in the first, second, or even third year of the red deer's life. In the first year the horns are but small bumps on the head; in the second they assume a pointed shape, and are then called *dags*; the third year develops the brow antler; in the next the bez-antler is produced; and the fifth year sees the royal antler bud forth, and then the animal becomes a *stag*. But the horns are not perfect until the sixth and following years form the successive branches of the crown. The number of antlers increases with the age of the stag; ten or twelve is, in general, the extreme, but some heads have borne horns of thirty antlers.

These stags, in the wild state, are almost extinct in the south of England; for those turned out to be hunted by the Royal hounds at Windsor are really half-domesticated. A hundred years ago they were numerous in the southern forests; but these were only the relics of the stately herds for which William I. made the New Forest, and for whose protection the ferocious forest laws were enacted. For them, chiefly, nearly seventy forests, and about seven hundred royal parks, were jealously kept, until the irritated baronage, gentry, and commoners of England insisted upon having their share also in the hunting of the deer. This animal must, indeed, have a place in the national records, if only for his former importance. Parliament no longer passes acts for his protection; rebellions are not organised under colour of a stag-hunt; noblemen have ceased to glory in the privilege of killing a deer on their way to and from Parliament. But we cannot even yet forget that "Chevy Chase" was fought in the stag's honour, and that the "stark" William of Normandy "loved the red deer as if he had been their father."

The *Roebuck* (*Cervus capreolus*), the smallest of our native deer, has but two antlers on the short horns, lives in small herds of five or six, frequents mountain districts, and must now be sought in Scotland, where their watchfulness will tax all the hunter's skill.

The *Fallow Deer* (*Cervus dama*) is the best known English species, being that usually kept in parks, where their beauty and gentleness are in harmony with the quietude of sylvan scenery. The horns have two antlers directed forwards; but the upper parts expand into what is called the "palmed" form, which is not fully developed till the animal is six years old.

The spotted variety is said to have been brought from the South of Europe or North Africa; but the brown kind were introduced by James I. from Denmark. The name *fallow* is descriptive of the light reddish-brown colour of the most ancient variety, and is derived from a Saxon word signifying a *light red*.

A few words on the growth and shedding of the horns are now requisite, as the production of such masses of bony matter every year must have a great influence on the vital functions of the animal. The new horn is at first but a soft and highly-sensitive knob, protected by a fine skin covered with hair, called the "velvet." If the "knob" be gently touched with the finger, it will be found to possess all the heat of inflammatory action. As the horn grows, the skin or "velvet" dries up, and is gradually rubbed off by friction against trees. The whole system of blood-vessels, which nourished the tender-growing horn, cease to act, and, finally, leave nothing but the faint marks of their presence on the solid horn. The *burr*, or bony ring at the base of the horn, has been the last formed, and we must now consider the influence of this on the shedding

of the horns. The continued pressure of the *burr* on the blood-vessels tends to obliterate these, and therefore to stop the flow of blood to the antlers. In time this failure of nourishment leads to the weakening of the horns at the frontal joint, and ultimately to their falling off. A few blood-vessels are even then torn asunder, as the part where the horn separates from the skull generally bleeds for a short time.

The *lacrimal sinus* (tear-channel) is an opening under each eye in most species of deer, the use of which is yet unknown. They are not "tear-channels," notwithstanding the name; nor are they "breathing places," as Gilbert White supposed, for Hunter has shown they have no connection with the nostrils or lungs. These organs are, therefore, at present a mystery.

Those of our readers who wish to know something of the numerous deer parks still kept up in England, and the modes of managing the animals in such enclosures, will do well to read Mr. Shirley's book on the deer parks of England.

The necessary limits of this paper have prevented us from referring to several foreign species, from entering into the details of "hunting science," and from describing the various modes in which the horns and skin of the deer are made "useful" to men.

If deer have had little direct influence on human civilisation, they, nevertheless, have contributed in all ages to the support of numerous rude tribes, and have offered, in feudal times, the temptations of the chase as a more innocent amusement than the battle-field. Does the man of the nineteenth century ask which is better, the hunting-field or the music-hall? An Englishman has but one answer.

LESSONS IN LATIN.—XXXV.

DEVIATIONS IN THE FIRST CONJUGATION.

2. Perfect, -UI; Supine, ITUM.

- Crepeo, crepi, crepare, crepitum, 1, to creak.
- Cubo, cubi, cubare, cubitum, 1, to lie down.
- Domo, domui, domare, domitum, 1, to tame, subdue.
- Mico, micui, micare (no supine), to glitter; so emico, emicui, emicare, emicatum, to dart forth; but dimico, I fight, has dimicavi, dimicare, dimicatum.
- Plico, plieui, plicare, plicatum, and plicitum, to fold; implico has implicui, implicatus (Cicero), and implicitus; explico and applico, in Cicero, have always -avi, -atum; replico, also, is regular.
- Sono, sonui, sonare, sonitum, to sound; part. fut. sonaturus.
- Tono, tonui, tonare (no supine), to thunder.
- Veto, vetui, vetare, vetitum, to forbid.

Let me impress on the student the necessity of committing these forms to memory. Only by committing them to memory—only by retaining them in your memory—can you become thoroughly master of them, and so have them in your possession for all necessary purposes. Be not deluded by any representations which may aim to make you think that you can become familiar with the Latin or any other language, unless at the expense of very considerable and very close labour. Again and again, twice or thrice over, must you acquire and repeat to yourself or to a friend all the forms I give; nor be satisfied that they are yours until, by repeated examinations and trials, you learn that you have them in your mind. You will not wisely to call in to your aid the principle of mutual stimulus and mutual instruction. Go over these forms aloud, several persons reciting them at once. For this purpose, it would be well to have a leader or drill-sergeant, to give the word, and keep the recital correct. When you have repeated a form or a vocabulary sufficiently, then proceed to examine each other. You would do well to call into play the same impulse and aid in writing and correcting the examples and exercises. If you are unable to get several to join you in the task, undertake to teach Latin to some poor boy who cannot afford to purchase the *POPULAR EDUCATOR*, or who may be neglected by his proper guardians. If two persons, with equal time and equal talents, began together to study Latin, the one teaching another, the other confining all his attention to himself, the former would outstrip the latter very easily, and make such progress as in a few months to defy competition. *Docendo discit.*

VOCABULARY.

Accubo, 1, to lie up to, to lie (sit) at table.	Et—et, both.	Perdōmo, 1, to tame thoroughly.
Aduro, adussi, adurere, adustum, 3, to set on fire, burn.	Evolvo, evolvi, evolutum, 3, to roll out, unfold.	Ploratus, -us, a complaint, a weeping.
Age, come.	Excubo, 1, to keep watch.	Reperio, 4, to find.
Applico, 1, to lean against.	Gemitus, -us, m., a groan.	Replico, 1, to unfold, reply.
Complicatus, complicatus, dark.	Increpo, 1, to scold.	Scaturigo, -inis, a spring.
Complico, 1, to fold together.	Nutus, -us, m., a nod, command.	Se applicare, to bring near, approach, apply to some one, to turn to some thing.
Crema, 1, to burn.	Passim, hither and thither, everywhere.	Verecundia, -æ, f., modesty.
Discedo, 3, to depart, go.	Percrepo, 1, to resound.	

EXERCISE 129.—LATIN-ENGLISH.

- Quis venit? 2. Fores crepuerunt. 3. Dux milites vehementer increpuit. 4. Tota urbs vocibus civium de victoriâ ex hostibus reportatâ exsultantem percrepuit. 5. Age, cubitum discedamus. 6. Romani multas gentes ac nationes armis perdomuerunt. 7. Docemur auctoritate nutuque legum, domitas habere libidines, coercere omnes cupiditates. 8. Ex hoc fonte ingentes scaturigines aquas emicuerunt. 9. Indorum sapientes ad flammam se applicant. 10. Indorum sapientes sine gemitu aduruntur. 11. Indorum sapientes, quum ad flammam se applicaverunt, sine gemitu aduruntur. 12. Cicero ad Molonem philosophum se applicavit. 13. Sapiens studet animi sui complicatum notionem evolvere. 14. Quum memoriam temporum replicaveris, et virtutum et vitiorum multa exempla reperies. 15. Quum urbs expugnata esset, omnia passim multorum puerorumque ploribus sonuerunt. 16. Terremur quum serenâ tempestate (weather) tonuit. 17. Nititur in vetitum. 18. Augustus carmina Virgilio cremari vetuit. 19. Augustus carmina Virgilio cremari contra testamenti ejus verecundiam vetuit.

EXERCISE 130.—ENGLISH-LATIN.

- The hinges of the door creaked. 2. The mother scolded her innocent son. 3. The soldiers kept watch all night. 4. The sailors will subdue the enemy's fleet. 5. I shall apply myself to Cicero (study under him). 6. I forbid you to study under Aristotle. 7. We shall strive for what is forbidden (vetitum). 8. The whole house sounded with the groaning of the sick men. 9. The city sounds with arms. 10. Jupiter subdues the other gods by his nod. 11. Everywhere groanings and weepings sound. 12. I have thoroughly tamed the lion.

DEVIATIONS IN THE FIRST CONJUGATION.

3. Perfect -UI; Supine, -TUM.

- Frico, fricui, fricare, fricatum, to rub; refrico, refrigui, refricare, refriguitum, to rub up, revive (p. f. refricaturus).
- Neco, necui, necare, necatum, to kill; eneco, enecui, enecare, enectum, to torture in killing.
- Seco, secui, secare, sectum, to cut, flog (p. f. secaturus).

4. Perfect, -I; Supine, -TUM.

- Juvo, juvi, juvare, jutum (juvaturus), to help; adjuvo, adjuvi, adjuvare, adjutum, adjuturus.
- Lavo, lavi, lavare, lautum, to wash.

VOCABULARY.

Adjuvare (acc.), to support, assist.	Frustra, in vain (E. R. frustrate).	petitum, 3, to ask, seek, fetch.
Aligare, 1, to bind to, or on.	Garrio, 4, I chatter.	Principio, at the first.
Attingo, attingere, attingi, attingitum, 3, to touch.	Garrulitas, -atis, talkativeness.	Principium, -i, n., a beginning.
Ceno, 1, to sup, dine.	Garrulus, -a, -um, chattering.	Quantopere, how much.
Congerio, 3, I carry.	Horreum, -i, n., a barn.	Refricare, to rub back, rub again.
Descendere, to cut down.	Oleum, -i, n., oil.	Reporto, 1, I bring back, gain.
Desiderium, -i, n., sense of loss, regret for.	Perfricare, to rub greatly.	Resecare, to cut off.
	Peto, peti, petere, petivi.	Solutus, -a, -um, free.

EXERCISE 131.—LATIN-ENGLISH.

- Vereor ne literis meis refrigerim desiderium ac dolorem tuum. 2. Tuis sceleribus reipublice præterita fata refricaturus es. 3. Dubium non est quin tuis sceleribus reipublice præterita fata refricaturus sis. 4. Tantulus summam aquam attingens, enectus siti fingitur a poetis. 5. Nesciens quantopere garrulus iste homo me garriendo enecuerit? 6. Caius Marius, quum secaretur, principio vetuit se alligari, nec quisquam ante Marium solutus dicitur esse secutus. 7. Agricola frumenta desecta in horrea congeriunt. 8. Nisi libidines ressecueris, frustra studebis beate vivere. 9. Quis nescit quantopere Cicero patriam juverit? 10. Non solum fortuna, sed etiam industria tua te in negotio tuo adjuvit. 11. Si quid fortuna milites nostros adjuverit, non dubitamus quin splendidam de hostibus reportaturi simus victoriam. 12. Exercitus maximis itineribus profectus est cives obsidione cinctos adjutum. 13. Ne prius cena quam manus laveris. 14. Corpus laetum aquam puram e vivo (running) flumine pete!

EXERCISE 132.—ENGLISH-LATIN.

1. Boys, rise, wash, and when you have washed (2nd fut.), apply to your business. 2. These women have tortured me with their chatter. 3. I do not doubt that these women have tortured thee with their chatter. 4. These talkative girls will kill me with their tongues. 5. I shall forbid my son to chatter. 6. Hast thou washed thy hands? 7. Come! wash thy hands well before you sit to table (*accumbere*). 8. They will not (*nolo*) wash their feet. 9. The father's word assists the son. 10. Ships are coming to assist the besieged city. 11. There is no doubt but the army of our general will speedily assist the city. 12. Hast thou cut thy thumb? 13. I have cut my leg. 14. Thou hast revived my grief. 15. Not willingly (*reluctant*) have I revived thy grief. 16. Fortune aids the brave. 17. The slave is bound. 18. The father forbids his son to be bound.

You ought now to be able to translate, at least with the aid of a dictionary, an easy Latin sentence. Make the trial. Here is a fable by Æsop. I have marked the order in which the words should be taken. Can you translate it?

Accipiter et Columba.

Columba, milvii metu accipitrem rogaverunt, ut eas defenderet. Ille annuit. At in columbare receptus uno die majorem stragem edidit, quam milvius longo tempore potuisset edere. Fabula docet, malorum patrocinium vitandum esse.

Have you read the whole carefully through? There are words you do not know the meaning of? Well, there are several with which you ought to be familiar. I will supply you with the signification of such as I suppose you do not know.

VOCABULARY.

Accipiter, -tris, m., a hawk. Milvius, -i, m., a kite. Possum, posse, potui, I am able. Patrocinium, -i, m., patronage. Strages, -is, f., slaughter. Edo, 3, I put forth, cause.

With this aid you ought to be able to make out the whole. Here, then, you have a test of your progress. If you cannot, after sufficient study, make it out, you may feel assured that you have not attended to my instructions as you should have done. However, I will supply you with a nearly literal translation, as another means of assisting you.

The Hawk and the Wood Pigeons.

The wood pigeons, through fear of the kite, entreated the hawk to defend them. He assented. But, being received into the dovecote, he committed more slaughter in one day than the kite could have done in a long time. The fable teaches you that the patronage of the wicked should be shunned.

I will also show you the grammatical connection of some of the words, and the reason of the condition in which they severally are; that is, I will give you in it a specimen of what is called Parsing.

Columba, from *columba*, *columba*, a wood-pigeon or dove; a noun feminine of the first declension, in the nominative case, plural number, being the subject to the verb *rogaverunt*.

Milvii, from *milvius*, *milvii*; a noun masculine of the second declension, governed in the genitive case by *metu*.

Metu, from *metus*, *metus*; a noun masculine of the fourth declension, in the ablative case, the cause, manner, or instrument being put in the ablative.

Accipitrem, from *accipiter*, *accipitris*; a noun masculine of the third declension, in the accusative case, being the object of the verb *rogaverunt*, which requires its object to be in the accusative.

Rogaverunt, from *rogo*, *rogare*, *rogavi*, *rogatum*, to ask; a transitive verb of the first conjugation, in the perfect tense, third person plural, to agree with its subject *columba*.

Ut, a conjunction, which, when, as *hæc*, it signifies a contemplated result, requires its verb to be in the subjunctive mood.

Eas, a demonstrative pronoun, referring to *columba*, from *is*, *ea*, *id*; the accusative plural feminine gender to agree with its noun, and governed by *defenderet*.

Defenderet, a transitive verb, from *defendo*, *defendere*, *defendi*, *defensum*, of the third conjugation, subjunctive mood, imperfect tense, third person singular number, agreeing with its subject *ille* understood, and governed by the conjunction *ut*.

Ille, from *ille*, *illa*, *illud*; a demonstrative pronoun referring to *accipiter*, the subject to the verb *annuit*.

Annuit, from *annuo*, *annuere*, *annui*, *annutum*; an intransitive

verb of the third conjugation, in the perfect tense, indicative mood, third person singular, to agree with its subject *ille*.

Annuit is made up of *ad* and *nno*; *nno* is connected with the noun *nutus*, a nod; so that the exact meaning of *ille annuit* is *he nodded assent*.

If we view the first sentence logically, it will stand thus:—

SUBJECT.	PREDICATE.
	Verb. Object.
Columba	rogaverunt accipitrem.

You thus see that *milvii metu* are accidental terms, terms not necessary to the sentence. *Ut eas defenderet* is equivalent to *eas defendere*, to defend them. Accordingly, *rogo* has two objects: first object, *accipitrem*; second object, *ut eas defenderet*. In the grammars it is said that *rogo*, with other verbs of asking, governs two accusatives, the one of the person, the other of the thing.

Now in the parts thus parsed nothing occurs but what you ought to know and be able to explain. Nay, more than this, you ought to be able to give the stems of the nouns and verbs. At any rate, I must enjoin it on you, in the attempts which I now recommend you to make in parsing, to go through every noun, every tense, etc., according to the models already supplied—to go through all the parts carefully in every instance. Remember, "practice makes perfect."

Two verbs in the fable may give you some trouble, namely, *edidit* and *potuisset*. *Edidit*, from *edo*, *edere*, *edidi*, 3, in the perfect tense, third person singular, is, like *edidit*, from *do*, formed by reduplication from the present *edo*. *Potuisset*, from the irregular verb *possum*, *potui*, *posse*, to be able, is in the subjunctive mood, pluperfect tense, third person singular, English, *might have been able*, or *could have done*.

KEY TO EXERCISES IN LESSONS IN LATIN.—XXXIII.
(Continued.)

EXERCISE 124.—ENGLISH-LATIN.

1. Heri amicus meus mortuus est. 2. Metuo ne amicus tuus mortuus sit. 3. Ne largitor malis pueris. 4. Deus piis largietur. 5. Aditus in cœlum semper bonis patet. 6. Metuo ut aditus in cœlum Alexandro pateat. 7. Quamdiu patria tua pace fruebar? 8. Quamdiu regis exercitus in patria nostra erit, pace fruamur. 9. Esne munere functus? 10. Ne abutere patris gratiâ. 11. Loquar tecum, sed non tibi blandiar. 12. Regi blanditus, laudem adeptus est. 13. Filius ne laudem adipiscetur? 14. Filius meus gloriam maximam adeptus est. 15. Gloria virtutem eximiam sequitur. 16. Se reditum esse, mihi pollicitus est. 17. Ille rediit. 18. Non, cras redibit. 19. Pueri se ipsi tuerentur. 20. Pueri se ipsi tueri debent. 21. Misereor et miserebor miserorum. 22. Ne obliviscere vitiorum tuorum. 23. Intra paucos dies proficiscar. 24. Quando revertes? 25. Veremini senes, O pueri.

KEY TO EXERCISES IN LESSONS IN LATIN.—XXXIV.

EXERCISE 125.—LATIN-ENGLISH.

1. God has given us a mind than which nothing is more excellent. 2. The victory cost us much blood. 3. The mother of all good arts is wisdom, than which nothing more productive, nothing more excellent has been bestowed by the everlasting God on the life of men. 4. God has placed the body as a garment round the soul (God has surrounded the soul with the body as with a garment), and has clothed it outwardly. 5. Those whose fathers or forefathers were distinguished by any glory (glorious deeds), endeavour for the most part to excel in the same sort of praise (praiseworthy deeds). 6. We ought to hold our parents very dear, because by them life has been given to us. 7. He has not conferred a benefit who unwilling has done good (who has done good unwillingly). 8. Who are more yours than those to whom you have restored safety, when they were destitute of hope? 9. The citizens showed themselves most energetic defenders of liberty. 10. A great multitude surrounded the orator in the market-place. 11. Eloquence has been given by nature for the safety of men. 12. Eloquence has been given by nature for the preservation of men. 13. A wicked orator turns eloquence to the ruin and destruction of the good. 14. What is so inhuman as to turn eloquence, given by nature for the safety and preservation of men, to the ruin and destruction of the good? 15. Pay had not been given to the soldiers for a long time. 16. Sedition arose among the soldiers. 17. Because pay had not been given for a long time, sedition arose among the soldiers. 18. You, my friend, will evince fidelity to me. 19. I know for certain that you, my friend, will evince fidelity to me. 20. Nothing hinders us. 21. Nothing will hinder us. 22. We may obtain a victory. 23. I believe that nothing will stand in our way so that we may not obtain the victory (to prevent our obtaining the victory). 24. The victory cost the death of many brave men. 25. We did not doubt that the victory would cost the death of many brave men. 26. Will you persist in your opinion? 27. I know not whether you will persist in your opinion.

EXERCISE 126.—ENGLISH-LATIN.

1. Classem duci dedit. 2. Tibi classem dabit. 3. Censesne se fratre meo classem daturum esse? 4. Nihil plaris hominibus constitit quam avaritia. 5. Deus mihi dedit sororem, quâ nihil mihi est carius. 6. Soror mea mihi se amantem per totam vitam præstabit. 7. Milites fortissimos præstiterunt, sed victoria morte multorum virorum fortium constitit. 8. Nihil obstat quominus victoriam adipiscamur. 9. Victoriam, credo, adipiscemur. 10. Socrates omnibus philosophis præstitit. 11. Quis nescit Socratem omnibus philosophis præstitisse? 12. Credis ne filium tuum omnibus sociis præstaturum esse? 13. Ingens hominum multitudo oratorem circumstat. 14. Stipendium militibus non est datum. 15. Stipendium militibus dabo. 16. Cave res seditio inter milites oriat. 17. Perstaturus es in sententiâ tuâ? 18. Nescio perstaturus ne sim in sententiâ meâ.

EXERCISE 127.—LATIN-ENGLISH.

1. Nothing hinders to prevent our doing that which pleases us most. 2. I will not oppose to prevent his reading everything. 3. Death does not deter a good man from consulting the welfare of the republic. 4. They may interrupt me to prevent my being honoured, provided they do not interrupt to prevent the republic from being well managed by me. 5. No pretext appeared sufficient to excuse any citizen from being present. 6. He surrounded the bed with a broad ditch. 7. He surrounds the enemies' camp with his army. 8. He surrounds himself with soldiers. 9. He will put his arms round your neck. 10. He surrounded the city with a mound. 11. I will endeavour to go beyond these limits with which I have surrounded myself. 12. He gave a distinguished character to the peace. 13. Patrons have invested him with this fame.

EXERCISE 128.—ENGLISH-LATIN.

1. Nihil impedit quominus puer bonus esse possit. 2. Famam tibi circumdabo. 3. Circumdabit mihi vestem. 4. Honorem sorori suæ circumdedit. 5. Circumdato urbi ignes, quominus cives egredi non possint. 6. Quominus adsis, nulla creusatio justa est.

LESSONS IN ALGEBRA.—XIII.

DIVISION OF FRACTIONS.

147. TO DIVIDE a fraction by a fraction.

Invert the divisor, and then proceed as in multiplication of fractions.

To invert a fraction, is to turn it upside down, or to make the numerator the denominator, and the denominator the numerator.

EXAMPLES.—(1.) Divide $\frac{a}{b}$ by $\frac{c}{d}$.

Here, we have $\frac{a}{b} \times \frac{d}{c} = \frac{ad}{bc}$. Ans.

To understand the reason of the rule, let it be premised that the product of any fraction by the same fraction inverted is always a unit.

Thus $\frac{a}{b} \times \frac{b}{a} = \frac{ab}{ab} = 1$. And $\frac{d}{h+y} \times \frac{h+y}{d} = 1$.

But a quantity is not altered by multiplying it by a unit. Therefore, if the product of the dividend by the divisor inverted be multiplied by the divisor itself, the last product will be equal to the dividend. Now, by the definition, "division is finding a quotient, which, multiplied into the divisor, will produce the dividend." And as the dividend multiplied by the divisor inverted is such a quantity, the quotient is truly found by the rule.

(2.) Divide $\frac{m}{2d}$ by $\frac{3h}{y}$.

Here we have $\frac{m}{2d} \times \frac{y}{3h} = \frac{my}{6dh}$. Ans.

Proof. $\frac{my}{6dh} \times \frac{6dh}{y} = \frac{m}{2d}$, the dividend.

148. To divide a fraction by an integer.

Divide the numerator by the given integer, when it can be done without a remainder; but when this cannot be done, multiply the denominator by the integer.

Thus the quotient of $\frac{a}{b}$ divided by m , is $\frac{a}{b}$.

149. To divide an integer by a fraction.

Reduce the integer to the form of a fraction, and proceed as before. Or, multiply the integer by the denominator, and divide the product by the numerator.

EXAMPLE.—Divide a by $\frac{c}{d}$.

Here, $a = \frac{a}{1}$; and $\frac{a}{1}$ divided by $\frac{c}{d}$ is $\frac{a}{1} \times \frac{d}{c} = \frac{ad}{c}$. Ans.

Or, $a \div \frac{c}{d} = \frac{a \times d}{c} = \frac{ad}{c}$. Ans. as before.

EXERCISE 23.

- | | |
|---|--|
| 1. Divide $\frac{x+d}{r}$ by $\frac{5d}{y}$. | 6. Divide $\frac{1}{a-b}$ by h . |
| 2. Divide $\frac{4dh}{x}$ by $\frac{4hr}{a}$. | 7. Divide $\frac{y}{4}$ by G . |
| 3. Divide $\frac{36d}{5}$ by $\frac{18h}{10y}$. | 8. Divide xy by $\frac{a+b}{2}$. |
| 4. Divide $\frac{ab+1}{3y}$ by $\frac{ab-1}{x}$. | 9. Divide $ab+cx$ by $\frac{3am}{12a}$. |
| 5. Divide $\frac{h-my}{4}$ by $\frac{3}{a+1}$. | 10. Divide $3ac-x$ by $\frac{a}{3}$. |

150. By a former definition "the reciprocal of a quantity is the quotient arising from dividing a unit by that quantity."

Thus the reciprocal of $\frac{a}{b}$ is $1 \div \frac{a}{b} = 1 \times \frac{b}{a} = \frac{b}{a}$.

Hence, the reciprocal of a fraction is the fraction inverted. For instance: the reciprocal of $\frac{b}{m+y}$ is $\frac{m+y}{b}$; the reciprocal of $\frac{1}{3y}$ is $\frac{3y}{1}$ or $3y$; the reciprocal of $\frac{1}{4}$ is 4. Hence the reciprocal

of a fraction whose numerator is 1, is the denominator of the fraction. Thus, the reciprocal of $\frac{1}{a}$ is a ; of $\frac{1}{a+b}$, is $a+b$, etc.

EXERCISE 24.

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|--|--|
| 1. Divide $\frac{3abc}{x-y}$ by $3ab$. | 15. Divide $\frac{ab^2c}{x^2y}$ by $\frac{a^2b^2c}{xy^2}$. |
| 2. Divide $\frac{10axx+15abx}{10-y}$ by $5ax$. | 16. Divide $\frac{2x-1}{x+2}$ by $\frac{x-3}{3x+1}$. |
| 3. Divide $\frac{3x+11}{x}$ by $3a$. | 17. Divide $\frac{y}{y-2}$ by $\frac{y-1}{y^2+2}$. |
| 4. Divide $\frac{a+1-x}{2cd}$ by d . | 18. Divide $\frac{a+b}{a+c}$ by $\frac{a-c}{a-b}$. |
| 5. Divide $\frac{a+b}{a}$ by $\frac{a}{b}$. | 19. Divide $\frac{a^3-a^2x}{a^2}$ by $\frac{ax-a^2}{x}$. |
| 6. Divide $\frac{x}{3ab}$ by $\frac{y}{4+2m}$. | 20. Divide $\frac{am}{yn}$ by $\frac{m}{yn}$. |
| 7. Divide $\frac{a+b}{3}$ by $\frac{4}{a-b}$. | 21. Divide $1+\frac{1}{a}$ by $1-\frac{1}{a^2}$. |
| 8. Divide $\frac{x+y}{a}$ by $\frac{b}{a}$. | 22. Divide $\frac{x+b}{x}$ by $\frac{x^2-b^2}{x^2y}$. |
| 9. Divide $\frac{3ab-6xy}{6}$ by $\frac{ab-2xy}{2}$. | 23. Divide $\frac{ax^2+ab^2}{x^4-ax}$ by $\frac{a^2x+a}{x^2-b^2}$. |
| 10. Divide $21abc$ by $\frac{7ab}{x}$. | 24. Divide $1-\frac{x^2}{x^2+a^2}$ by $1+\frac{a^2}{x^2-a^2}$. |
| 11. Divide $8xy$ by $\frac{2ab}{c}$. | 25. Divide $x^2+4a^2+\frac{15a^4}{x^2-4a^2}$ by $x+2a+\frac{3a^2}{x-2a}$. |
| 12. Divide $18ax$ by $\frac{(2a-x)y}{3m}$. | 26. Divide $0x^2-23+\frac{4}{x}$ by $3x-4-\frac{2}{x}$. |
| 13. Divide $\frac{18(a+x)}{3}$ by $\frac{2a(a-y)}{2m}$. | |
| 14. Divide $2a+\frac{3c+d}{x}$ by $x+\frac{y+b}{2}$. | |

KEY TO EXERCISES IN LESSONS IN ALGEBRA.

EXERCISE 21.

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|--|------------------------------------|------------------------------|
| 1. $\frac{3bd}{2cm}$. | 6. $\frac{acm}{bdy}$. | 11. $\frac{am+dm}{ah}$. |
| 2. $\frac{4ah+4zh}{my-2y}$. | 7. $\frac{2ah-2ad}{cmr-cmy}$. | 12. $\frac{3amr+3dr}{5am}$. |
| 3. $\frac{4ah+4hm}{3a-3m}$. | 8. $\frac{3d+bd}{hmr+2kn}$. | 13. $3m$. |
| 4. $\frac{4a+4h-am-hm}{3c+cd+3y+dy}$. | 9. $\frac{3a^2d-18ad}{7dhy+7hy}$. | 14. $h+3d$. |
| 5. $\frac{3}{8a+2r}$. | 10. $\frac{ah}{6}$. | 15. $\frac{b}{4}$. |
| | | 16. $\frac{h}{4}$. |

EXERCISE 22.

- | | | |
|---|-----------------------------|--------------------------------|
| 1. $\frac{4a^3}{21}$ | 6. $\frac{4a}{b}$ | 11. $2abc$ |
| 2. $\frac{ax + a^2}{a^2 - ax}$ | 7. $\frac{1}{x}$ | 12. $\frac{9by}{4}$ |
| 3. $\frac{5x^2}{2b}$ | 8. $\frac{y}{x}$ | 13. $x^2 - ax^2 - a^2x - 2a^2$ |
| 4. $\frac{3x + y}{3a + 4c}$ | 9. $\frac{3c}{4d}$ | 14. $\frac{ab}{(x-a)^2}$ |
| 5. $\frac{a + b}{4 + 5y}$ | 10. $\frac{a^2 - b^2}{12}$ | 15. $\frac{1 - a^3}{1 + b^3}$ |
| | 16. $\frac{4xy}{x^2 - y^2}$ | |
| 17. $\frac{18x^4 + 19x^3 - 93x^2 + 36}{36x^5 - 52x^4 + 96x^3 - 43x^2 + 12}$ | | |

LESSONS IN FRENCH.—LI.

§ 9.—FORMATION OF THE PLURAL OF NOUNS.

(1.) THE plural in French, as in English, is formed by the addition of *s* to the singular :—

Singular.	Plural.
maison, house.	maisons, houses.
ville, town.	villes, towns.

This rule applies also to infinitives used substantively : Le devoir, the duty; les devoirs, the duties.

(2.) First exception.—Nouns ending in the singular with *s*, *x*, or *z*, do not change in the plural :—

Singular.	Plural.
fil, son.	fil, sons.
voix, voice.	voix, voices.
nez, nose.	nez, noses.

(3.) Second exception.—Nouns ending in the singular with *au*, *eau*, *eu*, and *œu*, take *x* in the plural :—

Singular.	Plural.
bois, wood.	bois, woods.
chapeau, hat.	chapeaux, hats.
feu, fire.	feux, fires.
vœu, vow.	vœux, vows.

However, laudau, landau, forms its plural by adding *s*: landaus.

(4.) Third exception.—Nouns ending in *ou* form their plural by adding *s*, except the following, which take *x* in the plural :—

Singular.	Plural.
bijou, jewel.	bijoux, jewels.
caillou, pebble.	cailloux, pebbles.
chou, cabbage.	choux, cabbages.
genou, knee.	genoux, knees.
hibou, owl.	hiboux, owls.
joujou, plaything.	joujoux, playthings.
pou, louse.	poux, lice.

(5.) Fourth exception.—The following nouns ending in *ail*, change that termination into *aux* in the plural :—

Singular.	Plural.
baïl, lease.	baux, leases.
corail, coral.	coraux, corals.
émail, enamel.	émaux, enamels.
soupirail, air-hole.	soupiraux, air-holes.
sous-bail, under-lease.	sous-baux, under-leases.
travail, labour.	travaux, labours.
vantail, a leaf of a door.	vantaux, leaves of doors.
vitrail, stained glass window.	vitreaux, stained glass windows.

(6.) Fifth exception.—The following nouns have two forms in the plural :—

Singular.	Plural.
ail, garlic.	ails, ails.
pai, pale.	paux, pals.

The plural of *bétail*, cattle, is *bestiaux*; and *bercel*, sheepfold, has no plural.

* The other nouns in *ail* form their plural by adding *s*, viz., *détail*, detail; *attrail*, apparatus; *éventail*, fan; *gouvernail*, helm; *portail*, portal; *sérail*, seraglio.

(7.) Sixth exception.—Nouns ending in the singular with *al*, change that termination into *aux* in the plural :—

Singular.	Plural.
général, general.	généraux, generals.
cheval, horse.	chevaux, horses.
mal, evil.	maux, evils.

(8.) Ciel, aîeul, travail, œil, have two plurals :—

Singular.	Plural.
ciel, heaven, sky.	cieux, heavens, skies.
ciel, tester of a bed.	cieux, testers of beds.
ciel, sky of a picture.	cieux, skies of pictures.
ciel, roof of a quarry.	cieux, roofs of quarries.
ciel, climate.	cieux, climates.
aîeul, ancestor.	aîeux, ancestors.
aîeul, grandfather.	aîeux, grandfathers.
travail, labour.	travaux, labours.
travail, report of a minister to the head of the State, or of the heads of departments to ministers; trave.	travaux, reports of ministers to the head of the State, or of heads of departments to ministers; traves.
œil, eye.	yeux, eyes.

N.B.—*Œil* is found in many compound words, in which case it forms its plural regularly :—

œil-de-bœuf, oval window.	œils-de-bœuf, oval windows.
œil-de-chat, cat's eye (stone).	œils-de-chat, cat's eyes.

§ 10.—PLURAL OF COMPOUND NOUNS.

(1.) When two nouns form a compound substantive, both take the plural ending :—

Singular.	Plural.
chef-lieu, chief-place.	chefs-lieux, chief places.
lieutenant-colonel, lieutenant-colonel.	lieutenants-colonels, lieutenant-colonels.

(2.) When a compound noun is formed of two substantives joined by a preposition, the first only takes the plural ending :—

Singular.	Plural.
arc-en-ciel, rainbow.	arcs-en-ciel, rainbows.
chef-d'œuvre, masterpiece.	chefs-d'œuvre, masterpieces.

The words *tête-à-tête*, private conversation, and *coq-à-l'âne* (an incongruous discourse), remain unchanged in the plural.

(3.) When a noun and an adjective form a compound noun, both take the mark of the plural :—

Singular.	Plural.
porte-cochère, carriage-door.	portes-cochères, carriage-doors.
basse-cour, poultry-yard.	basses-cours, poultry-yards.

Exception.—In the compound noun, *nouveau-né*, first-born, the first component is invariable; *un nouveau-né*, *des nouveau-nés*; *une nouveau-née*, *des nouveau-nées*.

(4.) The mark of the feminine being left out in the adjective of compound nouns consisting of the adjective *grand* and a feminine substantive beginning with a consonant, that of the plural is also omitted in the adjective :—

Singular.	Plural.
grand'mère, grandmother.	grand'mères, grandmothers.
grand'messe, high mass.	grand'messes, high masses.

(5.) The words, *Monsieur*, *Sir*, *Mr.*, gentleman; *Madame*, *Madam*, or *Mrs.*; *Mademoiselle*, *Miss*, form their plural as follows :—

Singular.	Plural.
Monsieur, Sir, etc.	Messieurs, Sirs, gentlemen.
Madame, Madam, etc.	Mesdames, ladies, etc.
Mademoiselle, Miss, etc.	Mesdemoiselles, young ladies, etc.

(6.) In words composed of a verb, a preposition, or an adverb and a noun, the latter takes the form of the plural, provided, however, there is plurality in the idea :—

Singular.	Plural.
pas-droit, injustice.	passes-droits, injustices.
avant-garde, vanguard.	avant-gardes, vanguards.

+ *Bal*, ball; *cal*, callosity; *carnaval*, carnival; *chacal*, jackal; *napal*, napal; *regal*, treat; *serval*, serval; are exceptions, and take an *s* in the plural.

(7.) Compound nouns of which the second word indicates plurality, take *s* in the singular and plural :—

Singular.	Plural.
porte-cigares, cigar-case.	porte-cigares, cigar-cases.
porte-clefs, turnkey.	porte-clefs, turnkeys.

(8.) Words composed of two verbs, or of a verb joined to an adverb, or a preposition, are invariable :—

Singular.	Plural.
pas-partout, master-key.	pas-partout, master-keys.
pour-boire, coachman's fee.	pour-boire, coachman's fees.

§ 11.—NOUNS WHICH HAVE NO PLURAL.

(1.) The nouns of metals considered in themselves; as *or*, gold; *argent*, silver; *plomb*, lead; *étain*, pewter; *fer*, iron; *cuivre*, copper; *vif-argent*, quicksilver, etc.

(2.) Aromas; such as, *baume*, balsam; *encens*, incense, etc.

(3.) The names of virtues and vices, and some names relating to physical and moral man; as, *la jeunesse*, youth; *la beauté*, beauty; *la bonté*, goodness; *le courage*, courage.

(4.) Adjectives used substantively; as, *le beau*, the beautiful; *l'utile*, the useful, etc.

§ 12.—NOUNS WHICH HAVE NO SINGULAR IN THE SENSE HERE GIVEN.

Arrhes, earnest money.	Entraves, difficulties.
Annales, annals.	Fiançailles, betrothing.
Appas, charms.	Funérailles, funeral.
Arrrages, arrears.	Frais, expenses, costs.
Arrêts (étréaux), to be under arrest.	Gages, wages.
Assises, assizes.	Gens, people.
Broussailles, brushwood.	Luettes, spectacles.
Catacombes, catacombs.	Mœurs, manners.
Ciseaux, scissors.	Mouchettes, snuffers.
Confin, confines.	Pierres, jewels, diamonds.
Dentées, provisions.	Pincettes, tongs.
Vivres, provisions.	Pleurs, tears.
Décombres, ruins, rubbish.	Semailles, seeding time.
Étranges, new year's presents.	Ténèbres, darkness.
Environ, environs.	Tenailles, pincers.
Alentours, environs.	Vitraux, window-glass.

KEY TO EXERCISES IN LESSONS IN FRENCH.

EXERCISE 173 (Vol. II., page 386).

1. Sir, to what shall I have the pleasure of helping you? 2. I will ask you for a slice of that ham. 3. Have the goodness to help those gentlemen. 4. I will thank you for a slice of that boiled meat. 5. Shall I offer you a slice of that roast meat? 6. I am much obliged to you, Sir; I have enough. 7. Miss (Madam), shall I have the honour of helping you to a wing of this partridge? 8. I thank you, Sir, I would prefer one of those ortolans. 9. Sir, shall I send you (a little) soup? 10. Madam, have the goodness to help this young lady. 11. I will ask you for a little afterwards. 12. John, present this cutlet to that gentleman. 13. These vegetables are delicious. 14. Sir, I am very glad that you find them good. 15. Sir, will you not sit down? (Will you not sit down, Sir?) 16. I am exceedingly obliged to you, Sir, my father is waiting for me at home. 17. Have you not wished them good morning? 18. I have wished them good evening. 19. Have you bid them adieu (farewell)? 20. I have bid my brother adieu (farewell). 21. I have taken leave of them. 22. Have you desired them to walk in? 23. I have (desired them). 24. Gentlemen, the dinner is on the table. 25. Have the goodness to sit here.

EXERCISE 174 (Vol. II., page 386).

1. Madame, que vous servirai-je? 2. Je vous demanderai un morceau de jambon. 3. Vous enverrai-je une aile de cette volaille? 4. Je vous remercie, Monsieur. 5. S'il vous plaît, Monsieur. 6. Monsieur, aurai-je le plaisir de vous servir une tranche (un morceau) de ce jambon? 7. Je vous remercie, Monsieur, je prendrai de préférence un morceau de cette perdrix. 8. Vous offrirai-je un petit morceau de ce bouilli? 9. Je vous rends grâce, Monsieur; j'en ai. 10. Madame, vous enverrai-je un peu de potage? 11. Mille remerciements, Monsieur. 12. Monsieur, oserai-je vous prier de servir Mademoiselle? 13. Avec beaucoup de plaisir, Monsieur. 14. Jean, présentez cette soupe à Monsieur. 15. Ces ortolans sont délicieux. 16. Je suis bien aise que vous les trouviez bons. 17. A-t-on servi? 18. Non, Monsieur; on n'a pas encore servi. 19. Il est trop tôt. 20. Vous plaît-il d'y aller? 21. Il ne me plaît pas d'aller chez lui; mais j'irai si vous le désirez. 22. Irai-je avec vous? 23. Comme il vous plaira. 24. Votre ami ne veut-il pas s'asseoir? 25. Il vous est fort obligé; il n'a pas le temps aujourd'hui. 26. Avez-vous souhaité le bonjour à votre ami? 27. Je lui ai souhaité le bonsoir. 28. Ne lui avez-vous pas dit adieu? 29. Je lui ai dit adieu. 30. Ayez la complaisance de vous

mettre (asseoir) ici. 31. J'ai pris congé d'eux. 32. J'ai pris congé de tous mes amis.

EXERCISE 175 (Vol. II., page 387).

1. What hotel does your brother keep? 2. He keeps the hotel of Europe (European Hotel), . . . street. 3. Does your little boy keep himself very clean? 4. He keeps himself very clean. 5. What will be your decision? (By what decision will you abide?) 6. I will abide by what I have told you. 7. Do you not know what to decide? 8. I know perfectly what to decide (to abide by). 9. Why do you remain standing? 10. Because we have no time to sit down. 11. Have you not forbidden those young men to use such language? 12. I have forbidden them (lit. it to them). 13. Has not your coachman used very insolent language? 14. Are you not afraid of getting cold, by keeping the doors open? 15. We would prefer keeping them shut. 16. Does your master (teacher) recommend you to keep your head upright? 17. He recommends me to keep my feet outwards. 18. Why does not your friend keep you company? 19. His sister is indisposed; he is obliged to remain with her. 20. Has not your uncle filled the place of a father towards you? 21. He has been to me a father and mother.

EXERCISE 176 (Vol. II., page 387).

1. Ce monsieur tient-il table ouverte? 2. Il tient un hôtel à Paris. 3. Pourquoi tenez-vous les fenêtres ouvertes? 4. Nous les tenons ouvertes parce que nous avons trop chaud. 5. Votre ami n'a-t-il pas tenu sa parole? 6. Il a tenu sa parole; il tient toujours sa parole. 7. N'avez-vous pas dit à votre écuyer de tenir la tête droite? 8. Je lui ai dit de tenir la tête droite et les yeux ouverts. 9. Pourquoi ne tenez-vous pas compagnie à votre sœur? 10. Parce que j'ai promis d'aller chez mon cousin ce matin. 11. Avez-vous défendu à votre petit garçon de tenir de tels propos? 12. Je le lui ai défendu. 13. Tient-il un langage insolent? 14. Non, Monsieur. 15. À quoi vous en tiendrez-vous? 16. Je m'en tiendrai à ce que j'ai dit à M. votre père. 17. Avez-vous fait tenir cet argent à votre ami? 18. Je ne le lui ai pas encore fait tenir. 19. Le lui ferez-vous tenir demain? 20. Je le lui ferai tenir, si j'ai une occasion. 21. Pourquoi ne vous tenez-vous pas debout? 22. Parce que je suis fatigué. 23. Pensez-vous que la couleur de votre habit tienne? 24. Je crois qu'elle tiendra; elle paraît très bonne. 25. Ne regarderez-vous pas de près aux affaires de votre frère? 26. Je n'y regarderai pas de près. 27. Je m'en tiendrai à votre opinion. 28. Ne tenez-vous pas à votre opinion? 29. Je n'y tiens pas trop.

COMPARATIVE ANATOMY.—XVI.

GASTEROPODA.

THE classes of the Mollusca hitherto described have been passive in their habits and methods of feeding. We have seen that, for the most part, they are fixed or moved about at the mercy of the waves. Even when locomotive, locomotion is with them rather for the purpose of change of place than for definite progression. They are not pursuers of other animals, nor do they graze on the copious vegetation of the ocean, but they are dependent on what the current, which their cilia create, brings them for nutriment. With them the obtaining of fresh water for breathing and food for nutriment is one and the same act. In conformity with their habits they are almost devoid of organs of sense, and wholly without instruments for seizing prey. They have, it is true, a double nerve-knot above the mouth, but this, though in the position of a brain, can hardly be said to have the function of perception which we usually associate with the brain. Two other pairs of nerve-knots generally communicate with this, and they are often much larger than it. One of them has the two halves which compose the pair more or less removed from one another, each lying at the point of junction of the mantle and gills on its own side, and sending nerves to these organs. The other double knot lies in the foot, and is more or less developed according as the foot is large, small, or rudimentary. These three double nerve-knots are called respectively the cephalic (head), parieto-splanchnic (mantle and visceral), and pedal (foot) ganglia. In the case of the pecten, fringes of feelers and of eye-spots run round the mantle, and these imperfect and perhaps questionable organs of sense are supplied from the parieto-splanchnic ganglia; and this pair of ganglia no doubt represent the only nerve-knot which exists in the Tunicata and Polyzoa. In their case, also, it supplies nerves to the tentacles and other organs of sense which they possess. This pair of ganglia may therefore be considered to be the seat of perception rather than the cephalic. Another of the functions of the brain, however, may be assumed to belong to the cephalic pair of ganglia, and that is the function of volition. All the other

ganglia of the body are in direct communication with the cephalic pair, but not with the other two pairs. We may therefore consider that the cephalic pair is the originator of the voluntary actions, or is concerned in all those actions which the creature performs as a whole and individual. This pair is, so to speak, the central telegraph-station, and therefore may be considered to be in direct communication with the manager.

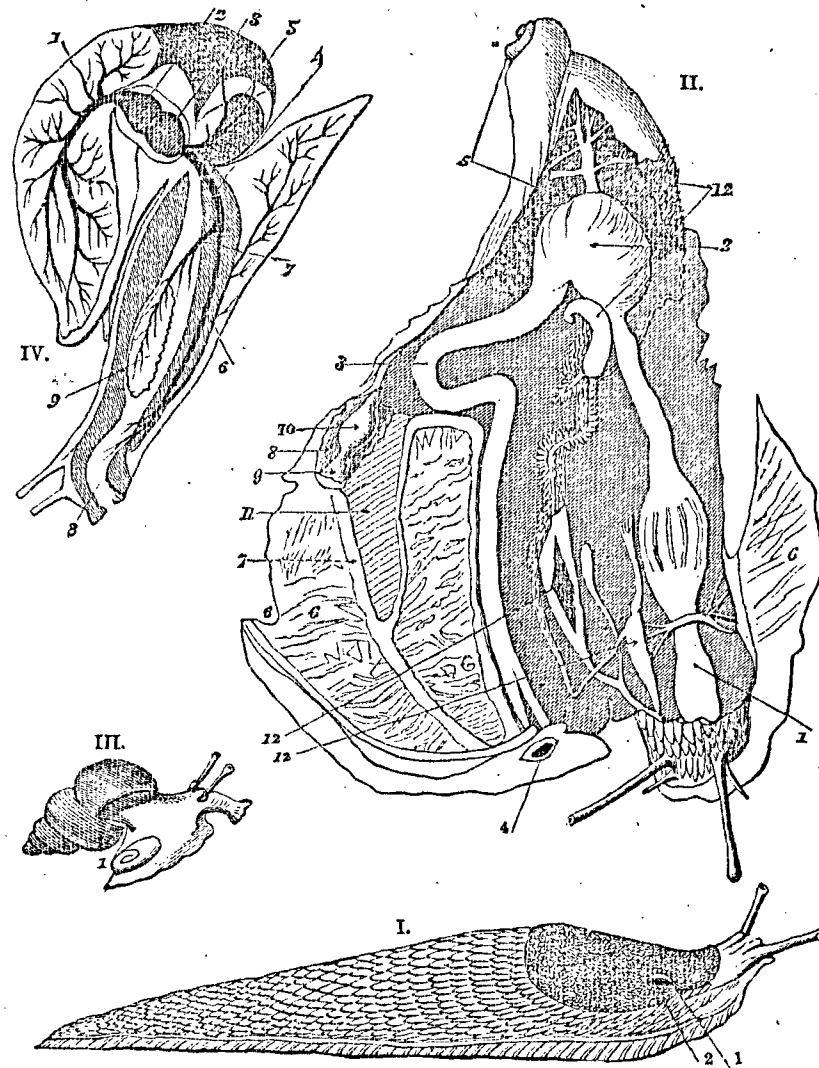
We have dwelt so long on the nervous system of the conchifer, partly because we had not space for it in our last lesson, and partly to indicate the contrast which it presents to that of the gastropods or headed molluscs. In these, though the nervous system no doubt consists of the same elements, they are more closely associated; and the ganglia, situated over the throat, behind the cavity of the mouth, are in direct communication with the organs of sense; and this is the same arrangement as is found both in vertebrates and articulates.

The Gastropoda derive their name from the usual form of the locomotive organ, which is so constantly found, though so variously developed, in the different members of this class. We found the foot in the Conchifera to be an organ which, in some, secreted the byssus or anchor-cable, in others bored holes, and yet in others accomplished jerky movements of the body. In the

swan-mussel of our rivers this instrument is applied to more regular and definite locomotion, and with the foot they may be seen ploughing their way through the soft mud which falls to the bottom of the stream. In their case, however, the foot is a rounded organ, and at its end is something like the human tongue, both in shape and structure. In the gastropods, or belly-walkers, the foot is a flat broad surface placed along the under side of the body, by means of which the animal can crawl over solid bodies. In some of the conchifers the shape of the foot is much more like that of the human foot than in any of the gas-

teropods; but in function, of course, the foot of the gastropods is much more like a foot than the same organ in the lower class. Usually the foot is a muscular, elongated sheet, broader and longer than the body of the animal, and acts at the same time as the wall of the body and the means of propelling it along. The whole rim of the foot all the way round is usually thickened, and can be closely applied to a smooth surface, while the central parts can be thrown in wrinkles. Thus the whole acts as a kind of sucker or holdfast, while all the middle parts, being alternately applied to the ground and dragged over it, effect a movement in which the whole animal participates. If the reader allows a slug to crawl up a pane of glass, and looks at it through the transparent medium, he will see successive waves moving all along the foot, showing that, while a series of points are fixed, the parts in between are moving, and the moving parts then become fixed, allowing the previously fixed parts to be pushed or pulled along by the contraction of the muscles embedded in the skin. Such a mode of progression, which may be called piecemeal, is, of course, very slow, but it is sure; and how should an animal without limbs move over a solid surface otherwise? Associated with this power of definite locomotion, slow as it is, the whole organism is modified.

Let us suppose that a Lamellibranch had the under part of its foot flattened into a broad muscular sheet, capable, not of pushing through soft mud, but of gliding over smooth rock: how could it make use of its new power of locomotion? It would, in the first place, be hampered with two immense shields, which, being ample enough to close upon its whole body, would certainly have their edges dragged over and ground upon the rock over which it passed, and thus wrenched about in relation to one another and to the soft parts of the animal united to them. Then its large sheets of unprotected membrane, called gills,

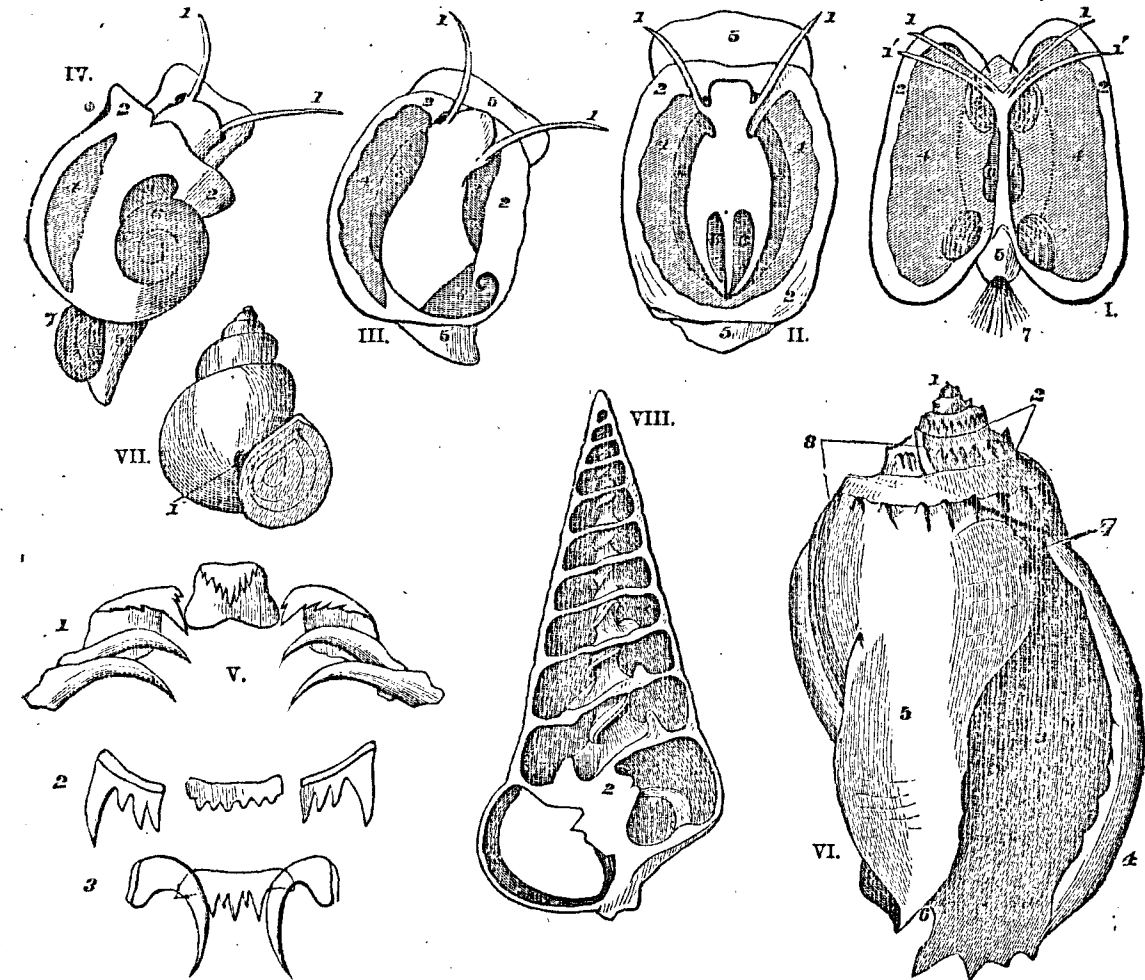


PULMOGASTROPODA.—I. ARION (THE BLACK SLUG). II. AGATHINA MAURITANICA. III. CYCLOSTOMA. IV. DIAGRAM OF THE CIRCULATION IN A SNAIL.

Refs. to Nos. in Figs.—I. 1, orifice of lung-chamber; 2, anus. II. 1, throat; 2, stomach; 3, intestines; 4, anus; 5, liver; 6, pulmonary diaphragm; 7, main vein; 8, chamber surrounding the heart; 9, auricle (receiver); 10, ventricle (distributor); 11, kidney; 12, generative organs. (N.B. In this diagram the shell has been removed and the skin cut along the back and opened; the floor of the lung also is thrown aside.) III. 1, operculum. IV. 1, lung vein; 2, auricle; 3, ventricle; 4, main artery; 5, liver artery; 6, foot artery; 7, stomach artery; 8, buccal cavity; 9, salivary gland.

would be liable to be torn and bruised. Add to these inconveniences the fact that it would be without eyes or feelers in the fore-part of the body to direct its course, or to take observations of what occurred, and we may judge that the benefits of travel would be quite outweighed by its dangers and troubles. In the gastropods, therefore, both shells are consolidated into one, and drawn out in an upward direction, so that, while the more delicate organs are securely lodged, the edges of the shell's mouth are withdrawn from the ground.

The gills are removed out of harm's way in a singular manner.



I., II., III., IV. DIAGRAMS OF UNIO, PATELLA, CALYPTREA, AND TURRO, TO SHOW THE STAGES OF TRANSITION FROM THE CONCHIFER TO THE TYPICAL GASTROPOD. V. A SINGLE SET OF TRANSVERSE TEETH FROM (1) A SEPHORATED GASTROPOD AND (2 AND 3) UNSEPHORATED GASTROPODS. VI. SHELL OF CASSIS. VII. PALUDINA. VIII. SECTION OF CERITHIUM.

Ref. to Nos. in Figs.—I., II., III., IV. 1, lips or tentacles; 2, mantle; 3, shell muscles; 4, gills; 5, foot; 6, position of the liver; 7, byssus; 8, operculum. VI. 1, spire; 2, suture; 3, aperture; 4, outer lip; 5, inner lip; 6, anterior canal for passage of the siphon; 7, posterior canal; 8, varices. VII. 1, umbilicus. VIII. 2, columella.

Those on one side (usually the right) are brought right up and placed on the animal's back, and there enclosed by a fold of the leathery skin, being placed partially in the last or largest part of the shell cavity, while those of the other side are entirely aborted or dispensed with. This arrangement gives a one-sidedness to the animal, and, perhaps, is the determining cause of the shell being made more compact in the method peculiar to gastropods, namely, by being twisted into a one-sided spiral or helix, as it is technically called. The head, with its feelers, eyes, and ears, can be thrust out from the shell and stretched well forward, so as to gain some acquaintance with those external objects which come within the line of march. In the illustration it is shown how the conchifer may possibly have been modified

into the gastropod by placing, side by side, some intermediate forms between the more typical turbo and the river-mussel (Unio). In patella (the limpet) it will be seen that the gills are still on both sides of the animal, as are also the muscles, though these have no longer the office of closing the shell, which, in this case, is consolidated into an equilateral cone. In the bonnet limpet one side of the breathing organs has been aborted, while in turbo both the breathing apparatus and muscles of one side are gone, and the whole animal is twisted, in its upper part, into a one-sided spire. In this case a rounded horny plate is

developed on the upper part of the foot, or rather tail of the creature, and this, when the animal pulls back its head and thin foot into the shell, closely closes the aperture. This operculum, as it is called, is supposed to be the representative of the horny byssus of the bivalve, being, as will be seen, similarly situated.

The alimentary canal commences with a mouth armed with hard parts. These are different in different creatures; but in all there is a fibrous plate, bearing teeth, placed on a cushion on the floor of the mouth. These teeth are usually directed backwards; sometimes the plate in which they are set is very long from point to back, the teeth being disposed in small cross rows set in parallel lines from one end of the plate to the other.

This is more especially the case in the carnivorous sea-snails, in which it is associated with a long extensible proboscis. In the land and fresh-water gastropods belonging to the order Pulmonifera, the number in a cross direction is very great, but the lingual ribbon is much shorter. This tooth-bearing ribbon is set on a muscular pad, which can move it backward and forward, so that the little flinty teeth act as a fine file. It is curious that these teeth are composed neither of horn nor shell (CaCO_3), but of silica (SiO_2) or flint. They are, of course, liable to be worn away; but the ribbon is formed from behind as fast as it wears away in front; and in some species, a considerable length of it lies coiled up in a sac or pouch, which stretches away from the mouth, ready to supply the place of the continual wear and tear. A few examples of the pattern of the teeth are given in the engraving, in which only one transverse row of three different species is given. The mouth is very muscular, and has on its front and upper wall a broad horny jaw, which is flat, with a cutting edge directed downward. It is of various shapes, and is often toothed on its lower edge. In some sea-snails the mouth-cavity is furnished with a long trunk, which can be unfolded from within, and used to grasp objects while they are played upon by the file-like tongue. Inside these trunks there is sometimes a toothed circle or collar of pointed fangs, which very much strengthen the hold that the creature has on its prey. It is singular that this tooth-bearing tongue is found universally, not only among the gastropods, but also among all the higher orders of the Mollusca, so that some classifiers have associated these together as the Odontophora, or tooth-bearers.

We proceed to describe the alimentary canal as it occurs in the arion, or common black slug, noticing such marked differences as occur in some other orders. A very small throat leads from the roundish buccal cavity, and this gradually dilates until it ends in a wider stomach. On the sides of the throat are situated two large glands for secreting saliva; but, though bound to the exterior of the throat by vessels, they discharge their secretion into the back part of the mouth by two ducts, which pass between the nervous collar and the attenuated portion of the throat. The stomach is of various shapes in the slugs; but in the example before us the hind part forms a kind of globular bag, and the two ducts from the liver enter just before this rounded portion. The intestine leads from the globe directly forward, so that this globular part occupies an acute angle in the course of the alimentary canal, and then, after being bent backwards and forwards two or three times, runs to a small orifice situated at the neck of the animal on the right side, close to the aperture of the breathing chamber. The stomach and intestine are closely embraced by lobes of the very large liver, which is so bound to them as to be with difficulty unravelled. In the case of the spirally-coiled and shell-bearing gastropods, the largest masses of the liver are situated in the small end of the spiral shell. In the aplysia (the sea-hare), and some other of the gastropods allied to it, the interior of the stomach is studded with shelly plates and spines, thus converting it into a gizzard.

The breathing organs of the Gastropoda are very various, and they have been made use of to divide the class into sub-classes and orders. Thus there are four main sub-classes founded mainly on these organs. In the Opisthobranchiata the gills are branched like a tree, or gathered together in bundles and placed on the hind parts of the body behind the heart, and are either naked or only partially protected by a fold of the mantle or shell. In the Pulmonifera there is a chamber situated over the neck, and covered completely in by a thick fold of the mantle. It only receives air through an aperture, which can be closed by a muscle running round it. The walls, and especially the floor, of this chamber have large blood-vessels in them, and so constitute a kind of lung in which the blood is aerated. In the Prosobranchiata the arrangement as to the chamber is much the same, but in the chamber lie one or two gills, usually of a comb-like or feathery form, and in these, and not in the walls of the cavity, the blood becomes oxygenated. In the carnivorous sea-snails the aperture is converted into a canal or siphon, which is often very long, and which has an anterior canal in the aperture of the shell for its accommodation, thus constituting the difference between the round-mouthed (Holostomata) and channelled (Siphonostomata) shells, as shown in the illustration.

All the land, and most of the fresh-water snails have lungs, and belong to the sub-class Pulmonifera, while the sea-snails have gills, and belong to the other sub-classes. Thus we see repeated in the Mollusca the two different kinds of breathing organs which are suited to aquatic and aerial life, which, in the vertebrates, are represented by the gills of fish and the lungs of the higher orders. From this we may infer that a gill is the necessary form of a water-breathing apparatus.

There is yet another sub-class of gastropods called Nucleobranchiata, or Heteropoda, which have various forms of breathing organs; but these are so different in the whole of their structure from the rest that it becomes a question whether they should be classed with the gastropods at all.

The central organ, which aids the circulation of the blood, is situated in the typical gastropods in the partition or diaphragm, as it is called, which lies between the breathing chamber and the chamber containing the viscera. It is always at the hind part of this, and receives the blood from the gills, or central vessel of the lungs, into a chamber or auricle. From this it passes through a valve to the more muscular ventricle, and is driven by this into a vessel which almost immediately divides into two, one of which goes forward to the mouth and foot, and the other backward to the liver and all those organs which are situated in the recesses of the shell or hind cavity of the abdomen. The blood, thus distributed by vessels, is said to escape from them into the general cavity of the body, and from thence enters by wide openings to the veins which convey it to the gills or lungs. In the case of the lung-breathers it enters the diaphragm from behind, and runs in two main vessels along the margins of this organ, and then sends off smaller vessels or sinuses towards the central vessel. In the Prosobranchiata the sexes are distinct; but in the Pulmonifera and Opisthobranchiata the sexes are united in one individual, and the organs in the former are of very complicated and peculiar structure. In the neighbourhood of the heart there is an organ which is considered to be a kidney, which eliminates the azotised products caused by the wear and tear of the vital action. This organ seems also, in some species, to have the office of introducing water into the blood-system from without, as it has an opening on the one side into the breathing-chamber, and on the other into the pericardium or external heart-chamber.

The front part of the mantle-fold, which covers in the breathing-chamber, is thickened into a collar, and this is the instrument for secreting the shell. The shape, and foldings of this edge of the mantle give rise, in the process of growth, to all those beautiful shells whose variety of colours and shape must be known to the reader.

One of the characteristics of the gastropods is the immense amount of sticky mucus they are constantly exuding, and which makes, in the land-slugs, a serious draught on their nutritive system. This is secreted by glands all over the skin, but also, in some species, by special larger glands on the back of the neck.

The nervous ganglia, though they probably consist of the same elements as in the Conchifera, are gathered together so as to form a ring round the throat, situated at the narrow part just behind the buccal mass. The muscular system is almost wholly confined to the skin, except that a broad muscle arising from the lower part of the body runs to the head, and slips of this muscular sheet also go up the tentacles, so that, when in contraction, the tubular tentacle and eye-stalks are pulled into the body at the same time as the head is withdrawn. In the common snail the eye-tentacles are the longest, and are set highest on the head, while the lower pair is simply tactile. In many sea-snails there is only one pair of tentacles, the ends of which are feelers, while the eyes are set on the sides or bases of these. The eyes, themselves, are not highly organised, being little more than a nerve expanded in front of a dish of black pigment, and placed behind a transparent cornea. Ear-sacs, with round ear-stones in them, are found in many Gastropoda.

The Gastropoda are the most typical class of the Mollusca—that is, they are the central group, showing fewer points of relation to the other sub-kingdoms than the other classes, and possessing a very large number of species nearly allied to one another, so that there are fewer gaps in the series. They, in fact, occupy a similar position with regard to the Mollusca as the insects do to the Articulata, or the osseous fishes do to the Vertebrata.

LESSONS IN ARCHITECTURE.—XVIII. PRIVATE HOUSES.

HOMER, in his "Odyssey," informs us that the houses and even the palaces of ancient Greece were constructed of wood; and among others he particularly describes that of Ulysses, at Ithaca. It is stated that the private houses of the early Romans were small, and that the doors were left unclosed during the principal meal. As wealth and luxury increased, the size of their houses became so great as to accommodate, in no very extraordinary cases, no less than four hundred slaves under a single roof. The height of private houses at Rome was restricted by the Emperor Augustus to seventy feet; but the irregularity of the city became so great, that in one sense its conflagration by Nero turned out a public good. For, being passionately fond of building, this made way for his architectural plans, and rendered Rome afterwards a regular and splendid city. Notwithstanding these improvements, there was a great want of conveniences in the private architecture of the Romans. There was a general absence of chimneys and of windows; and the only light received in the rooms was through an aperture formed in or over the door. In these respects, therefore, they were little removed from the rude cottages of the poor still to be seen in the remote parts of our own country. One reason for the neglect of comfort in their private dwellings was, that they were not a domesticated people; they lived in public and for the public, and their society was to be found in the Forum and public porticoes. A military people are sure to be thus circumstanced; and France, at least in Paris since the first revolution, has presented a similar spectacle to the observer. Her inhabitants live in cafés, and in clubs or societies, but not at home.

The arrangement of ancient houses greatly differed from the modern in the formation of their internal courts. These were usually constructed so that each was surrounded by apartments which, when lighted from within, prevented the domestic concerns of the family from being overlooked by any one not included within the walls. From a passage in Plautus, it does not appear that this construction always answered the purpose; and in Seneca mention is made of the annoyance to which the neighbours were subject from the disorderly conduct of those persons who changed night into day by indulging in the false refinement and late hours of the age in which he lived. In the Roman houses, also, there appears to have been, after the Eastern fashion, a remote or inner court for the apartments of the females, accessible only by an outer court for those of the males, and of the servants. The information conveyed to us in the works of Vitruvius has received singular illustration and confirmation within a period less than a century, from the excavations at Pompeii, Herculaneum, and Stabia, cities which were overwhelmed by a tremendous eruption of Vesuvius in A.D. 79, and which contained houses built and inhabited by Romans belonging to the age of Vitruvius. These excavations exhibit curiously paved streets, having the tracks of carriage-wheels marked on them, and houses built of brick and rubble-work put together with mortar, all the materials being of very inferior quality, except the interior coating of plaster, to which they appear to have been chiefly indebted for their durability. This plaster was composed of lime and pounded marble, a substitute for stucco, and by its use a perfectly smooth and polished surface was obtained, nearly as hard as marble. With this kind of stucco the smallest apartments at Pompeii are found to be lined; and this lining is painted with various and brilliant colours, and embellished with subjects either in the centre or at equal distances, like panels. Painted imitations of variegated marbles, forming, perhaps, a species of scagliola, also decorate the walls of the houses. Few blocks of real marble are found, except in monumental and public buildings; though, in imitation of the wealthy Romans, the Pompeians inserted pieces or slabs of this material in their walls, and employed art to give them higher tints than those they possessed by nature. They also discovered a method of veining slabs with gold; and leaves of this metal covering the beams, walls, and even roofs of the houses, were introduced in great profusion. They covered their floors with cement, in which small pieces of marble or coloured stones were regularly embedded (inlaid work) with ornamented margins and a device in the centre. The doors of their houses, being formed of wood, have been reduced to charcoal by the

burning lava, and in some cases are found in an incomplete state; they turned on pivots, and were fastened by bolts which hung upon chains. Bedsteads are found, made both of wood and iron; but their beds were made generally of carpets and vests, spread upon the ground. The articles of household furniture and convenience found in these remarkable ruins are utensils of every kind in silver, brass, stone, and earthenware, with vases of every size and adapted to every use; trumpets, bells, grid-irons, colanders, saucepans (some lined with silver), kettles, ladles, moulds for jelly or pastry, urns for keeping water hot on the principle of the modern tea-urn, horn-lanterns, spits, and, in fact, every article of kitchen or other furniture used by us, except forks; chains, bolts, scourges, dice (some said to be loaded); a complete toilet, with combs, thimbles, rings, paint, pins, earrings, pearls, etc. But for more enlarged details, we must refer to the work of Sir William Gell and J. P. Gandy, entitled "Pompeiana," in which there is given a detailed account of the excavated houses of Pompeii.

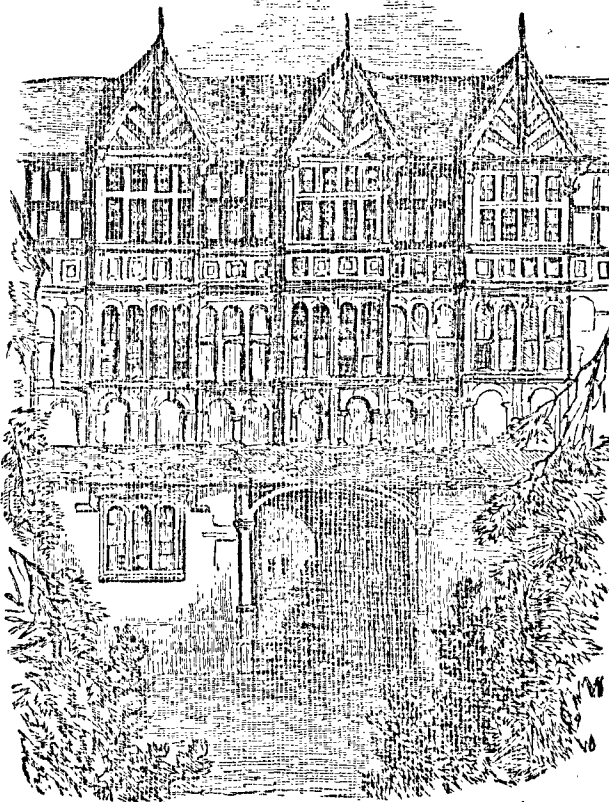
The excavated towns above mentioned being small, furnished specimens chiefly of houses inhabited by Romans of the middle and lower classes. At Rome itself, the excavations of the villa Negroni have made us acquainted with the nature of purely Roman houses, and of the higher class. To this may be added the following description, by himself, of the winter residence of Pliny the Younger, at Laurentinum, situated at the distance of seventeen miles from Rome, which gives us a more distinct conception of the villa of a wealthy nobleman of that city:—

"My villa is large enough to afford all desirable accommodation without being extensive. The porch before it is plain, but not mean, through which you enter a portico in the form of the letter D, which includes a small but agreeable area. This affords a very commodious retreat in bad weather, not only as it is enclosed with windows, but particularly as it is sheltered by an extraordinary projection of roof. From the middle of this portico you pass into an inward court, extremely pleasant, and thence into a handsome hall, which runs out towards the sea. On every side of this hall there are either folding-doors or windows equally large, by which means you have a view from the front and the two sides, as it were, of three different seas; from the back you see the middle of the court, the portico, and area; and by another view you look through the portico into the porch, whence the prospect is terminated by the woods and mountains which are seen at a distance. On the left-hand side of this hall, somewhat farther from the sea, lies a large drawing-room, and beyond that a second of a smaller size, which has one window to the rising and another to the setting sun. The angle which the projection forms with this drawing-room retains and increases the warmth of the sun; and hither my family retreat in winter to perform their exercises. Contiguous to this is a room forming the segment of a circle, the windows of which are so placed as to receive the sun the whole day; in the walls are contained a set of cases, which hold a collection of such authors whose works can never be read too often. Thence you pass into a bed-chamber through a passage which, being boarded, and suspended over a stove which runs underneath, tempers the heat, which it receives and conveys to all parts of this room. The remainder of this side of the house is appropriated to the use of my slaves and freedmen; but most of the apartments are neat enough to receive any of my friends. In the opposite wing is a room ornamented in a very elegant taste; next to which lies another room, which, though large for a parlour, makes but a moderate dining-room. Beyond is a bed-chamber, together with its ante-chamber, the height of which renders it cool in summer, as its being sheltered on all sides from the winds makes it warm in winter. To this apartment another of the same sort is joined by a common wall. From thence you enter into the grand and spacious cooling-room belonging to the bath, from the opposite walls of which two round basins project, sufficiently large to swim in. Contiguous to this is the perfuming-room, and the sweating-room, and to that the furnace which are the two little than a costly marble which is a room in this is a large room, and under the garden and the garden and

its run round the back of it, the wind which look upon the entrance to the villa, and into a pleasant kitchen-garden. From thence an enclosed portico extends, which, by its great length, you might suppose erected for the use of the public. It has a range of windows on each side, but on that which looks towards the sea they are double the number of those next the garden. Before this portico lies a terrace, perfumed with violets. On the upper end of the terrace and portico stands a detached building in the garden, which I call my favourite; and, indeed, it is particularly so, having been erected by myself. It contains a very warm winter room, one side of which looks upon the terrace, the other has a view of the sea, and both lie exposed to the sun. Through the folding-doors you see the opposite chamber, and from the window is a prospect of the enclosed portico. On that side next the sea, and opposite the middle wall, stands a little elegant recess, which, by means of glass doors and a curtain, is either laid open to the adjoining room or separated from it. Adjoining to this is a bed-chamber, which neither the voice of the servants, nor the murmuring of the sea, nor even the roaring of a tempest can reach. This profound tranquillity is occasioned by a passage which separates the wall of the chamber from the garden; and thus by that intervening space every noise is excluded. Annexed to this is a small stove-room, which, by opening a little window, warms the bed-chamber to the degree of heat required. Beyond this lie a chamber and ante-chamber, which enjoy the sun, though obliquely, from the time it rises till the afternoon."

The houses of princes and the palaces of emperors occupied a great extent; and besides baths, gymnasiums, and gardens, they had sometimes attached to them a basilica, a theatre, or a circus. Before the establishment of the Roman dominion in Gaul, the inhabitants, according to Vitruvius, lived in huts of a cylindrical form, covered with shingle or thatch; and in Normandy many vestiges of these are still to be found. The Romans gave to those people whom they conquered their religion, laws, and customs; and the Gauls then built their houses like those of Rome. Numerous villas or country-houses, and rural engineering residences, were to be seen in Gaul; many of these houses, as well as those built in towns, were constructed of wood placed on foundations of stone. Erected in a climate different from that of Italy, the Gallo-Roman houses, especially in the northern parts, were warmed by subterranean flues, called hypocausts. During the first ages of the monarchy, houses in Gaul were made of wood, exactly similar to those of the north.

In a description of the palace of Attila, given by some valuable information is to be rected during with façades towns of the es, Perigueux, cimens of this



GABLED HOUSES OF THE THIRTEENTH CENTURY.

kind of architecture; and there are some also in Germany and Italy. In the thirteenth century the Gothic style was used as much in private as in monumental or public architecture. In the town of St. Yrieix there is a very fine house built in this style; and others are found at Montpazier, in the department of the Dordogne. Rural constructions, farms, and granges are found at Meslay in Touraine, and near Coulommiers. Both in the fourteenth and fifteenth centuries wooden houses were common all over Europe. In the accompanying illustration is a representation of one of these, of which many specimens may be seen in England. The storeys of these houses were executed in wood, that is, projecting one over the other—an arrangement by which the upper rooms were enlarged, but which rendered the lower storeys unwholesome, the light and the air being prevented from entering freely into the rooms they contained. This system of projecting storeys is proved to be of Oriental origin, from the circumstance that it did not make its appearance in Europe until after the time of the Crusades. This system, which was proper in the East, for defending the lower part of the house from the light and heat of the sun, was absurd in climates where these were always welcomed as delightful visitors. After the thirteenth century houses were constructed so that the gable-end of the roof fronted the street; and in the Middle Ages "to have the gable to the street" indicated the right of citizenship. Built without a regular plan, these houses were, owing to the arrangement of the windows, both dark and inconvenient within; the stairs were constructed outside, and in front of the building; and in the recesses thus formed, turrets were built, which in the fifteenth century were greatly multiplied, and added to their decoration. Wooden façades were generally more decorated than those constructed of stone; the posts, the beams, and the panels were covered with a profusion of sculpture in wood; the roofs were decorated with elegant crests and graceful spires, surmounted with whimsical weather-vanes. During the Renaissance period, the outward appearance of houses, as well as their internal accommodations, were greatly improved; the façades became more regular, and wood more rare; and when used, it was mixed with brick and stone. From this period, sculpture were spread over the fronts of houses with a profusion, and with more taste. There are many specimens of houses built in the Renaissance style, in France, Germany, and Italy, as well as in England. The ancient towns of Rouen and Moret, in France, furnish some of the finest examples. From that time to the present day, private architecture has extensively improved; the outward appearance of our houses has become less fantastical, and the interior arrangements more convenient. Since the mediæval period the improvement in private edifices, both in decoration and adaptation to the comfort of human life, have been considerable; but the progress of domestic architecture in England will be traced in future volumes.

தமிழ்நாடு ஆவணக்காப்பக நூலகம்,
எழும்பூர், சென்னை-600 088.

திவனைத்தாள்.

சே எண் :

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