

Government of Madras.

EDUCATIONAL DEPARTMENT

Recd.

Regd.

} 1909.

Enclosures

Spare copies

G.O., No. 579, 22nd October 1909.

Vacation lectures.

Directing that the expenses connected with the University — be met from the grant of Rs. 50,000 sanctioned in 1908 instead of from the interest accruing on that sum.

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GOVERNMENT OF MADRAS.

EDUCATIONAL DEPARTMENT.

Read—the following papers:—

I

G.O., No. 622, Educational, dated 1st September 1908.

ABSTRACT.—Sanctioning a grant of Rs. 50,000 to the University of Madras towards the cost of establishing University vacation lectures on the condition that this sum is invested in Government securities and the interest on the investment is devoted to the purpose stated and also according sanction to the expenditure, on the establishment of lectureships and studentships, of the interest on the accumulated University Fee Fund.

II

Letter—from FRANCIS DEWSBURY, Esq., B.A., LL.B., Registrar, University of Madras.

To—the Secretary to Government, Educational Department.

Dated—Senate House, the 10th September 1909.

No.—2631.

I have the honour to invite your attention to G.O., No. 622, Educational, dated 1st September 1908, communicating the sanction of Government to the grant of Rs. 50,000 to the University of Madras towards the cost of establishing University vacation lectures on the condition that this sum is invested in Government securities and that the interest thereon is devoted to the purpose stated, also stating that if further funds are required for this purpose the University must find them from the Fee Fund or other funds belonging to the University, and also sanctioning the expenditure of the interest on the accumulated Fee Fund on the establishment of Lectureships and Studentships.

2. I have further to draw your attention to correspondence ending with G.O., No. 287, Educational, dated 14th May 1909, sanctioning the appropriation of a sum of Rs. 1,700 from the University Fee Fund in addition to the sum of Rs. 7,000 previously sanctioned towards the expenses of the vacation lectures to teachers delivered during the Christmas holidays of 1908.

3. It is now represented to the Syndicate that since a large number of teachers were unable to obtain admission to the lectures last year as provision could only be made for strictly limited numbers, the courses should be repeated this year, at the same or other centres, and the Syndicate is of opinion that the courses have proved of such value to the teachers who attended them that their repetition is very desirable.

4. The accumulated interest on the grant of Rs. 50,000 received from Government available for this purpose under G.O., No. 622, Educational, dated 1st September 1908, above referred to will be about Rs. 1,833, a sum wholly inadequate to meet the necessary expenditure, which will probably amount to eight or nine thousand rupees.

5. Acting under the sanction accorded by Government to the proposals of the University for utilising the accumulated Fee Fund for the institution of Lectureships for the Honours Courses and of research Studentships, the Syndicate is submitting to the Senate for consideration draft regulations which will involve the appropriation of all available funds for these purposes.

In this connection I have the honour to refer you also to your memorandum, No. 2387, dated 17th November 1908, requesting a statement showing the financial

position of the University and estimates of the money that might be spent with advantage during the next few years, and also to the reply of the Syndicate thereto contained in my letter No. 3845, dated the 3rd December 1908.

6. It will therefore be seen that the University is unable out of its own resources to repeat last year's courses this year. Moreover the Syndicate is of opinion that although the University is probably better able to organise and carry out Vacation Lecture Courses than the Department of Education would be, the responsibility for such work properly belongs rather to the Department than to the University, since its direct result in the improvement of school teaching belongs to that part of Education in which the University is only indirectly interested.

7. I am therefore directed to request that if His Excellency the Governor in Council considers it desirable to repeat the courses of vacation lectures this year, he will be pleased to supplement the special grant already made towards the cost of these lectures by such an amount as will be sufficient to provide funds to cover the expenditure involved, i.e., by a sum of Rs. 7,000 for this year only; or that he will be pleased to modify G.O., No. 622, Educational, so as to allow of the sum of Rupees 50,000 granted thereunder being treated not as an endowment for vacation lectures, which are regarded as merely a temporary expedient, but as a sum which may be spent on such lectures during the next few years, any surplus remaining being with the consent of Government added to the fund for the maintenance of Lectureships for the University Honours Courses.

8. I have to request the favour of very early orders on this letter with a view to their being communicated to the Senate at its meeting on the 15th October next.

III

Memorandum No. 1689-2, Educational, dated 2nd October 1909.

In connection with the application of the Syndicate of the University of Madras for a grant of Rs. 7,000 from Provincial funds to meet the cost of vacation lectures during the current year, the Government request that they may be furnished with information on the following points, namely:—

- (1) whether these lectures are given to teachers in colleges;
- (2) whether fees are charged for attending the lectures;
- (3) where the lectures are given;
- (4) what fees are paid to the lecturers; and
- (5) what supervision regarding the quality of the lectures is exercised.

2. The Syndicate states that these lectures are regarded as merely a temporary expedient and contemplates their continuance only during the next few years. The Government would be glad of a fuller exposition of the policy which is proposed regarding the lectures and of the reasons why it is considered that they need not be regularly continued.

(By Order.)

C. A. SOUTER,
Under Secretary to Government.

To the Registrar of the University of Madras.

IV

Letter—from FRANCIS DEWSBURY, Esq., B.A., LL.B., Registrar, University of Madras.

To—the Under Secretary to Government, Educational Department.

Dated—Senate House, the 8th October 1909.

No.—2860.

In reply to Memorandum No. 1689-2, dated 2nd October 1909, having reference to the proposed University vacation lectures, I have the honour to furnish the required information upon the points detailed therein as follows. The questions of

Government are in the present tense; the replies, since they have reference primarily to the procedure of last year, are in the past. Should Government, however, sanction either of the proposals in my letter, it is the Syndicate's intention to repeat the same courses next year, though perhaps not at the same centres. In future years, while the procedure adopted would probably not greatly differ from that of last year the subjects of the courses would be determined by the needs of the schools.

I. (1) The vacation lectures were not given to teachers in colleges but to a selected number of applicants from among the graduate teachers of recognised high schools in the Presidency. Each high school teacher desiring to attend a course of lectures was required to make application in the prescribed form, a copy of which is enclosed. The selection of teachers was made by a special committee of the Syndicate.

(2) No fees were charged. The objection to this that might suggest itself, that gratuitous lectures would be little valued, is in the opinion of the Syndicate met by the facts that except for a few unavoidable cases of absence with leave all the teachers attended all the lectures, and that the Lecturers have all placed on record their appreciation of the industry and keenness of the teachers.

(3) The lectures were delivered at the following places:—

Madras—

in History and Geography at the Pachaiyappa's College.
in Physics and Chemistry at the Presidency College.

Trichinopoly—

in all the above subjects at St. Joseph's College.

No payment was made in respect of the use of these college premises which were kindly placed at the disposal of the University by the authorities concerned.

(4) The following fees were paid to lecturers and demonstrators:—

	RS.
To 4 Lecturers in History and Geography (each)	300
To 8 Demonstrators in History and Geography (each)	50
To 4 Lecturers in Physics and Chemistry (each)	500
To 4 Chief Demonstrators in Physics and Chemistry (each)	150
To 10 Demonstrators in Physics and Chemistry (each)	100

(5) The lecturers were appointed by the Syndicate on the recommendation of the respective Boards of Studies. A list of the Lecturers and Demonstrators is appended to this letter. The lecturers when appointed were required to confer with one another and to submit jointly the proposed syllabuses of the lectures to the respective Boards of Studies, by whom they were forwarded to the Syndicate for approval. A printed copy of the approved syllabuses is also appended.

II. The lectures were instituted because, while under the New University Regulations a more thorough and intelligent study in schools, of Physics, Chemistry, History and Geography is required, it was known from such sources as the reports of Inspectors of Schools and of the Syndicate's Committee on the Matriculation Examination that there were too few teachers in high schools competent to direct such study. It is not however anticipated that this state of things will continue indefinitely. Vacation lectures if continued for a few years should do much to improve the teachers already in the schools, and as the New University Regulations with their more exacting courses come into force it is to be hoped that the graduates who adopt the teaching profession will be increasingly more competent than their predecessors. The lectures may in fact be described as an attempt to meet the dilemma arising from the introduction of the New University Regulations. These presuppose efficient school teaching, but are themselves expected in time to produce it. The vacation lectures are therefore for the moment a necessary complement of college and University teaching which must however in time supersede them.

ENCLOSURES.

UNIVERSITY OF MADRAS.

Centre.	Subject.	Lecturer.	Demonstrator.
Madras	History ..	Mr. K. Ramanaiahariyar, B.A., Assistant Professor, Pachaiyappa's College, Madras.	Mr. J. B. Gnanaolivu, B.A., L.T., St. Peter's High school, Tanjore. Mr. N. Subrahmanyam, B.A., L.T., Assistant Training College, Rajahmundry.
	Geography ..	Mr. K. A. Viraraghavachariyar, B.A., Assistant Pachaiyappa's College, Madras.	Mr. S. Viraraghavachariyar, B.A., Assistant, Pachaiyappa's College. Mr. K. Srinivasan, B.A., L.T., Assistant, Pachaiyappa's College.
	Chemistry ..	Mr. W. Erlam Smith, M.A., Professor, Presidency College.	Mr. T. K. Hanumanta Rao, B.A., L.T. (Chief) Assistant, Presidency College. Mr. G. Sambamurti, B.A., L.T., Assistant, Rajahmundry College. Mr. K. Seshu Aiyar, B.A., L.T., Assistant, Salem College.
	Physics ..	Mr. R. Littlebailes, M.A., Professor, Presidency College.	Mr. M. C. S. Anantapadmanabha Rao, M.A., L.T., (Chief) Assistant, Presidency College. Mr. R. Satakopa Aiyangar, M.A., Assistant, Rajahmundry College. Mr. V. Appa Rao, B.A., L.T., Assistant, Rajahmundry College.
Trichinopoly.	History ..	Mr. K. V. Rangaswami Aiyangar, M.A., Assistant Professor, Maharaja's College, Trivandrum.	Mr. K. Chidambara Aiyar, B.A., L.T., Headmaster, St. Berchman's High School, Changanacherry. Mr. C. N. Krishnaswami Aiyar, M.A., L.T., late Assistant, Maharaja's College, Trivandrum.
	Geography ..	Mr. P. T. Srinivasa Aiyangar, M.A., Principal, Mrs. A.V.N. College, Vizagapatam.	Mr. G. Ramadas, Assistant, Mrs. A.V.N. College, Vizagapatam. Mr. K. Satyanarayana, Assistant, High School, Parakkimedi.
	Chemistry ..	The Rev. A. Haas, S.J., Professor, St. Joseph's College, Trichinopoly.	The Rev. H. Le Calvez, S.J. (Chief) Assistant Professor of Science, St. Joseph's College, Trichinopoly. The Rev. H. Hartenstein, S.J., Science Master, High School, Palankottah. The Rev. A. Bonhoure, S.J., Science Master, St. Mary's Secondary School, Madura. The Rev. Turland, S.J., Assistant Science Master, St. Joseph's College, Trichinopoly.
	Physics ..	The Rev. D. Honor, S.J., B.A., Professor, St. Joseph's College, Trichinopoly.	The Rev. G. Gombert, S.J., B.A. (Chief) Professor, Sacred Heart College, Shembaganoor. Mr. N. Ramaswami Aiyar, B.A., Science Teacher, Pasumalai College. Mr. T. S. Abhirama Aiyar, M.A., Student of the St. Joseph's College, Trichinopoly. Mr. N. Tyagarajan, B.A., L.T., Science Teacher, National High School, Negapatam.

UNIVERSITY OF MADRAS.

NOTIFICATION.

VACATION LECTURES TO TEACHERS.

Courses of lectures on History, Geography, Physics and Chemistry will be delivered in Madras and Trichinopoly during the coming Christmas vacation for the benefit of teachers in colleges and high schools.

The lectures will be free, and admission will be by ticket only. Teachers in colleges and high schools wishing to attend the lectures must make application in the form below on foolscap paper to the Registrar of the University before 14th November 1908. The applications of those teachers only who are engaged in teaching the subjects of the lectures will be considered.

Physics and Chemistry Lectures.

The Courses on Physics and Chemistry will be delivered simultaneously at Presidency College, Madras, and at St. Joseph's College, Trichinopoly. Applications must be made for one course only. No teacher will be allowed to attend both the course on Physics and the course on Chemistry.

The lectures will relate to—

- the best methods of teaching, keeping in view the standard prescribed for the Matriculation Examination,
- the development of manipulative skill in the teachers,
- the requirements of schools in the matter of equipment.

The courses will extend over four weeks, commencing on or about 23rd December 1908.

Teachers attending these courses should be prepared to absent themselves from their school duties for a week after they re-open in the new year.

History and Geography Lectures.

The courses on History and Geography will be delivered at centres to be decided in Madras and in Trichinopoly; and will be arranged so as to allow of teachers attending both courses. The courses will extend over a fortnight, commencing towards the end of December.

The lectures will relate to the principles and methods of teaching History and Geography in Schools, and will include practical work in the drawing up of syllabuses, the making of plans, etc.

These courses will conclude before the ordinary time for the re-opening of schools after the Christmas holidays.

Note.—Full information will be published later and sent to each selected applicant for the lectures, with detailed particulars of the places, dates and times of the lectures, and of everything required in the lecture room. No individual inquiries from intending applicants can be answered.

FORM OF APPLICATION.

Application for admission to the course of lectures to be delivered during the Christmas vacation, 1908.

Name of teacher.	
Academic qualification.	
Where employed.	
Classes and subjects taught by the applicant.	
Subject of the course applied for.	
Centre selected.	
Postal address to which the admission ticket should be sent.	

Date.

Signature.

Countersigned.

Principal or Headmaster.

(By order.)

F. DEWSBURY, B.A., LL.B.,

Registrar.

Senate House, 26th October 1908.

Order—No. 579, Educational, dated 22nd October 1909.

In the circumstances now represented, the Governor in Council is pleased to direct that the expenses connected with the vacation lectures be met from the grant of Rs. 50,000 sanctioned in G.O., No. 622, Educational, dated 1st September 1908, instead of from the interest accruing on that sum as laid down in that order.

2. The Syndicate of the University will be requested to furnish Government with a detailed account of the expenditure incurred each year on these lectures, and to see that the most economical arrangements possible are made.

(True Extract.)

W. FRANCIS,

Ag. Secretary to Government.

To the Syndicate of the University of Madras.
 " Director of Public Instruction.
 " Financial Department.

EDUCATIONAL DEPARTMENT.

NOTES CONNECTED WITH G.O., No. 579, EDUCATIONAL, DATED 22ND OCTOBER 1909.

[SUBJECT.—*Application from the University of Madras for a grant of Rs. 7,000 to meet the cost of vacation lectures during the current year.*]

Previous papers.

G.O., No. 190, Educational, dated 28th March 1905.	
" " 29 " " 18th January 1906.	
" " 59 " " 1st February "	
" " 89 " " 13th " "	
" " 371 " " 26th May "	
" " 797 " " 7th December "	
" " 570 " " 31st August 1907.	
" " 696 " " 15th October "	
" " 144 " " 25th February 1908.	
" " 622 " " 1st September "	
" " 709 " " 12th October "	
" " 72-3 " " 4th February 1909.	
" " 101 " " 19th " "	
" " 106 " " 22nd " "	
" " 178 " " 23rd March "	
" " 287 " " 14th May "	
" " 421 " " 16th July "	

From the University of Madras, dated 10th September 1909, No. 2631.

The University of Madras requests that the Government will be pleased to make a grant of Rs. 7,000 for this year only, to cover the cost of the vacation lectures to teachers to be delivered during the ensuing Christmas vacation.

2. In G.O., No. 622, Educational, dated 1st September 1908, the Government sanctioned a grant of Rs. 50,000 to the University of Madras towards the cost of establishing University vacation lectures, on the condition that the sum was invested in Government securities and that the interest on the investment was devoted to the purpose stated and not diverted therefrom without the special sanction of Government. It was also stated that, if further funds were required for this purpose, the University must find them from the Fee fund or other funds belonging to the University.

3. In Mr. Dewsbury's letter No. 2769, dated 16th September 1908, the University pointed out that if the grant of Rs. 50,000 made in G.O., No. 622, Educational, dated 1st September 1908, were to be invested as required by Government, it would not be available to any extent to meet the cost of vacation lectures during 1908-1909, and the sanction of Government was requested to meet the cost of the lectures in 1908-1909 from the University Fee fund. The Government sanctioned this proposal in G.O., No. 709, Educational, dated 12th October 1908. The cost of the lectures amounted to Rs. 8,700—*vide* G.O., No. 287, Educational, dated 14th May 1909.

4. The University now states that the interest on the sum of Rs. 50,000 which was granted by Government to be invested for the purpose of meeting the cost of vacation lectures during the current year will be about Rs. 1,833 and that this sum

is wholly inadequate to meet the necessary expenditure, which will probably amount to eight or nine thousand rupees. The University further states that the cost of

But it was expressly laid down in this Government Order that the expenditure on the establishment of lectureships and studentships should be limited to the interest on the accumulated University Fee fund, less any sum that may with the sanction of Government be devoted to vacation lectureships.

K. RANGASWAMI AIYANGAR—18-9-09.

5. The University observes that although it (the University) is probably better able to organize and carry out vacation lecture courses than the Educational Department would be, "the responsibility for such work properly belongs rather to the (Educational) Department than to the University, since its direct result in the improvement of school teaching belongs to that part of education in which the University is only indirectly interested."

6. The University accordingly requests that, if the Government consider it desirable to repeat the courses of vacation lectures this year, they will be pleased to make a grant of Rs. 7,000 for this year only, or that they will be pleased to modify G.O., No. 622, Educational, dated 1st September 1908, so as to allow of the sum of Rs. 50,000 being treated not as an endowment for vacation lectures, which are regarded as merely a temporary expedient, but as a sum which may be spent on such lectures during the next few years, any surplus remaining being, with the consent of Government, added to the fund for the maintenance of lectureships for the University Honours courses.

7. It is for consideration whether a grant of Rs. 7,000 may be given to the University to meet the cost of the vacation lectures during the current year. There is an allotment of Rs. 17,000 under the head "UNIVERSITY" in the Educational budget for the current year, from which the grant applied for by the University may be met, if it is decided to grant it. This allotment of Rs. 17,000 represents mainly the unspent balance of the special grant of 4.90 lakhs made by the Government of India for University and collegiate expenditure in this Presidency.

T. KANAKASUNDRAM PILLAI—17-9-09.

In G.O., No. 622, Educational, dated 1st September 1908, in which a grant of Rs. 50,000 was made to the University of Madras towards the cost of establishing University vacation lectures, it was expressly laid down that the amount should be invested in Government securities, that the interest on the investment should be devoted to the purpose and should not be diverted therefrom without the special sanction of Government and that, if further funds were required for the vacation lectures, the University must find them from the Fee fund or other funds belonging to the University.

2. In accordance with the above order, the cost of the vacation lectures for 1908, amounting to Rs. 8,700, was met by the University from the interest on the University Fee fund, no interest being available in that year on the investment of Rs. 50,000, which had just then been made.

3. The University now asks for a grant of Rs. 7,000, to supplement the interest of Rs. 1,833, from the above investment, in order to meet the cost of the lectures this year, as "all available funds" will be appropriated for lectureships and studentships, in regard to which draft regulations are, it is stated, being submitted by the Syndicate to the Senate. No details are furnished of the scheme of lectureships and studentships above referred to or the probable annual expenditure which it will involve. But apparently no portion of the interest on the accumulated Fee fund will be available for expenditure on these lectures, and in view of the value of the course

of lectures referred to in paragraph 3 of the Registrar's letter, it is for consideration whether a grant of Rs. 7,000 which has been asked for by the University may be sanctioned. The alternative request of the University to utilize a portion of the funded capital for expenditure in the current year seems inadmissible.

Please compare paragraph 3 of India's letter on page 2 of G.O., No. 421, Educational, dated 16th July 1909.

4. It is submitted that the Director of Public Instruction may be consulted u.o. in the matter, with special reference to paragraph 6 of the Registrar's letter.

K. RANGASWAMI AIYANGAR—20-9-09.

The remarks of the Director of Public Instruction may be invited u.o.

C. A. SOUTER—20-9-09.

Yes; there is no information as to whether the lectures are worth all this money and whether the expenditure could not be reduced without much damage being done. It is not clear where the lectures are held, or for how long, or what individual lecturers are paid for them. Government are invited to invest, previous protests notwithstanding, on the University's Guarantee of profits.

W. FRANCIS—21-9-09.

To the Director of Public Instruction

OFFICE OF THE DIRECTOR OF PUBLIC INSTRUCTION.

The classes are doing much good and the University is doing the work well.

They will be wanted for one or two years more only.

I do not see why the expenses should not come out of the Rs. 50,000 which was given for the purpose. Why tie them down to the interest when the expenditure is temporary?

I do not think that the expenditure could be reduced.

The Registrar could of course furnish details if called upon to do so.

A. G. BOURNE—26-9-09.

EDUCATIONAL DEPARTMENT.

Where is it stated that the scheme is only temporary, for one or two years more?

W. FRANCIS—27-9-09.

Attention is solicited to paragraph 7 of the letter from the Registrar of the University, in which he states that these vacation lectures are regarded "as merely a temporary expedient". It may also be inferred from the same paragraph that these lectures will be continued "during the next few years".

K. RANGASWAMI AIYANGAR—27-9-09.

Please see the notes with G.O., No. 622, Educational, dated 1st September 1908. It was therein laid down that only the interest on the Rs. 50,000 was to be used for lectures, the balance being met from the Fee fund, etc. It is now a year since that order issued and the University should have set apart some of the Fee fund to supplement the Rs. 1,800 accruing from the Rs. 50,000. But the situation is altered by the fact that the lectures are now said to be a temporary measure. This was not contemplated (or seems not to have been) in 1908. If the lectures are temporary there does not seem much object in tying up the principal with the result that Government will be asked for several years to contribute something more. It seems best, therefore, to relax the condition in paragraph 1 of G.O., No. 622.

C. A. SOUTER—27-9-09.

I have since spoken to Dr. Bourne about this. He says that these lectures have been very useful indeed in bringing teachers into touch with the newest methods of teaching certain subjects, especially Mathematics. The scheme was one of his own ideas. The teachers took an unexpected interest in the lectures and it was found

desirable to repeat some of them to those who had been crowded out in the first year. But now nearly all the available teachers have attended, and it seems likely that in a year or two more there will be no further demand for lectures for perhaps three, four or more years. This aspect of the case does not seem to have been set out in any of the papers, or the original grant would not perhaps have taken the form of a lump grant instead of an annual subsidy.

Submitted that the money now asked for may be paid out of the lump grant and that the same may be done again, if necessary, next year. A note of the amounts thus handed over to the University will remain on record in this office and if any of the Rs. 50,000 remains unspent the existence of it can be pointed out to the University if they come up with any other demands.

There is a good deal of force in the University's contention that these lectures are less its business than that of the Educational Department and they are totally distinct from the post-graduate lectureships and studentships which are paid for from the Fee fund. G.O., No. 622, Educational, dated 1st September 1908, seems to bracket the two unnecessarily.

W. FRANCIS—28-9-09.

The lectures are, I suppose, given to teachers in colleges. I imagine if they were properly managed they would pay their way. There seems no information whether fees are charged, where the lectures are given, the fees paid to the lecturers, the guarantee that exists that the lectures are really good. I think before Government gives away the money we should have some information on these points.

Nor do I understand why these lectures are supposed to be necessary only for the next few years.

Methods of teaching Mathematics now up to date will, I suppose in a few years, be as out of date as the methods which the present lectures are supposed to be going to improve.

I quite agree that these lectures if given gratis or at a loss are not the business of the University very directly. But if they were run without such a heavy loss the University would be doing its duty in giving them just as Oxford and Cambridge give similar lectures in their vacation.

We must ask for particulars of the lectures before we spend our capital on them.

M. H[AMMICK]—29-9-09.

Draft asking for the above information.

W. FRANCIS—30-9-09.

Draft submitted for approval.

T.K.—30-9-09.

K. RANGASWAMI AIYANGAR—30-9-09.

C. A. SOUTER—1-10-09.

Issue.

W. FRANCIS—2-10-09.

[Memorandum No. 1689-2, dated 2nd October 1909.]

From the Registrar, University of Madras, dated 8th October 1909, No. 2860.

The Registrar of the University furnishes the detailed information asked for in Memorandum No. 1692-2, dated 2nd October 1909. The details furnished have reference to the lectures held last year and the Registrar of the University observes that if the Government should sanction either of the proposals made by the Syndicate, it is intended to repeat the same courses next year though perhaps not at the same centres.

2. (i) *Whether the vacation lectures are given to teachers in Colleges.*—The Syndicate states that the vacation lectures were not given to teachers in colleges but to a selected number of applicants from among the graduate teachers of recognised high schools in the Presidency. Each high school teacher desiring to attend the lectures was required to submit an application in the prescribed form and the selection was made by a special committee of the Syndicate.

3. *Whether fees are charged for attending lectures.*—The Syndicate replies that no fees were charged for the lectures.

4. (3) *Where the lectures are given.*—The lectures were given last year at the Pachaiyappa's and Presidency Colleges in Madras, and at St. Joseph's College in Trichinopoly, in the following subjects:—

Madras.—In History and Geography at the Pachaiyappa's College; in Physics and Chemistry at the Presidency College.

Trichinopoly.—In all the above subjects at St. Joseph's College.

The Registrar adds that no payment was made in respect of the use of the above college premises which were kindly placed at the disposal of the University by the authorities concerned.

5. (4) *What fees are paid to the lecturers.*—The following fees were paid to lecturers and demonstrators:—

	RS.
To four lecturers in History and Geography	300 each.
To eight demonstrators in History and Geography	50 "
To four lecturers in Physics and Chemistry	500 "
To four chief demonstrators in Physics and Chemistry	150 "
To ten demonstrators in do.	100 "

The total amount of fees was Rs. 5,200.

6. (5) *What supervision is exercised regarding the quality of the lectures delivered.*—The Syndicate states that the lecturers were appointed by it on the recommendation of the respective Boards of Studies. The lecturers when appointed were required to confer with one another and to submit jointly the proposed syllabuses of the lectures to the respective Boards of Studies, by whom they were forwarded to the Syndicate for approval. A list of the lecturers and demonstrators and also a printed copy of the syllabuses will be found in the current file.

7. With reference to the question why the Syndicate regard the lectures as merely a temporary expedient to be continued only during the next few years, the Syndicate states that the lectures were instituted because, while under the New University Regulations a more thorough and intelligent study in schools, of Physics, Chemistry, History and Geography was required, it was known from the reports of Inspectors of Schools and of the Syndicate's Committee on the Matriculation Examination that there were too few teachers in the high schools competent to direct such study. The Syndicate however does not now anticipate that this state of things will continue indefinitely. Vacation lectures if continued for a few years should, the Syndicate considers, do much to improve the teachers already in the schools and it hopes that as the New University Regulations with their more exacting courses come into force, the graduates who adopt the teaching profession will be increasingly more competent than their predecessors. "The lectures may in fact be described as an attempt to meet the dilemma arising from the introduction of the New University Regulations. These presuppose efficient school teaching, but are themselves expected in time to produce it." The Syndicate observe that the vacation lectures are therefore for the moment a necessary complement of College and University teaching which must, however, in time supersede them.

8. If the Government should sanction a grant of Rs. 7,000 or the utilization of the sum of Rs. 50,000 granted for vacation lectures in G.O., No. 622, Educational, dated 1st September 1908, the Syndicate proposes to repeat the same courses of lectures next year though perhaps not at the same centres. In future years, the

Syndicate considers, there will not be much difference in the procedure adopted, but the subjects of the courses of lectures would be determined by the needs of the schools.

9. The above information was obtained with reference to Honourable Member's remarks on page 4 *supra*.

K. RANGASWAMI AIYANGAR—12-10-09.

C. A. SOUTER—14-10-09.

W. FRANCIS—15-10-09.

Yes. I agree that on the explanation now afforded the expense of these lectures may be met from the grant itself and not from the interest from the grant. We had

I cannot understand why such highly-paid demonstrators are required for the history lectures, but it is a matter no doubt the Syndicate know more about than I do.

better ask for an account of the expenditure each year, and suggest that every care be taken to see that the most economical arrangements possible are made for the lecturers.

M. H[AMMICK]—21-10-09.

M. H[AMMICK]—21-10-09.

Draft approved.

W. FRANCIS—22-10-09.

[G.O., No. 579, Educational, dated 22nd October 1909.]

University of Madras.

Syllabuses of Vacation Lectures on Geography, History, Physics and Chemistry

1908-09

*Circulated to High Schools and to Colleges affiliated
to the University of Madras*

N.B.—The University does not accept responsibility for the contents which are intended for information only.

SENATE HOUSE, MADRAS,
July, 1909. }

FRANCIS DEWSBURY,
Registrar.

80 579 Ed
22-10-09

University of Madras.

LECTURES IN GEOGRAPHY

Lecture I

What is Geography?

Meaning of Geography.—The conception of it in the past. Recent development in the conception of it. Geography, midway between humanist and scientific studies, its peculiar educational value. Geography, the open door to all sciences. Correlation of Geography-study in the lower stages, to the study of Languages, Nature-study, Drawing, Sand and Clay-modelling, School excursions, Arithmetic and Geometry. The relation of Geography to Geology, Physiography, Physics, Chemistry, Botany, etc., and to History. Map and its bearing to Geography.

PRACTICAL WORK

1. Drawing to scale the plan of a town or village.
2. Measuring distances in the maps of various projections.
3. Estimating area with squared paper.

Lecture II

Principles of teaching Geography

Fundamental principles of all teaching. 'The brain grows while the hand works.' Need for scientific method in teaching the subject. Meaning of scientific method. Objects aimed at—(i) Development of imagination, (ii) Ability to appreciate facts—not topographical knowledge. Cause and effect in Geography teaching. Its importance to the solution of problems in Geography. The influence on man of terrestrial local conditions and place relations. Need for getting practical work done in the class-room. Drawing of maps in every lesson. Kind of maps to be drawn vary. Relief maps—Use of colour—Outlines to be supplied for some purposes, but not when the outlines are being learnt. Teachers' special maps. Questioning on maps. Atlas and its use. Map-building sheets. The desirability of a Geographical class-room fitted up as a Geographical institute.

PRACTICAL WORK

Exercises on *Hachures* and *Contours*.

Do. in drawing sections of relief maps.

Lecture III

Geography teaching in the early stages

The right method of teaching Geography in the lower classes—of expanding steadily from the home to the world. The syllabus to be progressive—School-room, village or town, The Home area, The Home Country, and The World as a whole.

II and III Standards.—No stiff or severe and logical method. Didactic teaching to be avoided. Aim to be the training of imagination in the sphere of space. Story Telling. Concrete materials to be relied upon to form correct images. Aids to Geography teaching in this stage.

IV Standard.—The study of the Home area, i.e., The Madras Presidency. Natural divisions to be studied. Start with areas similar in type to local forms. Aim to be to show how these features contribute more or less directly towards supplying materials needed for food, clothing and shelter. Aids to Geography teaching in this stage. The Study of the Home Country, the next step. Map to be the basis of study. Comparison and contrast with Home Area.

I, II and III Forms.—Study of the world as a whole including the size, shape and motions of the earth. The Seasons—knowledge needed of these Only of most elementary kind. Aids to Geography teaching in this stage. Teaching might be based upon illustrations of differences in the customs and manners of life in different parts of the world. Large surface features to be taught in this stage. The Syllabus to be concentric. What is meant by concentric syllabus? Examples.

PRACTICAL WORK

Drawing of syllabuses for the III and IV Standards and for the Lower Secondary forms on the concentric System.

Lecture IV

The teaching of the Relief

The teaching of Geography in the higher stages. The syllabus to be based upon the study of regions. An inverse Progressive syllabus needed, narrowing the sphere of Geographical investigation and increasing the depth. The study of land forms with the aid of Relief models. Physical maps. Mill's Pyramid of the departments of Geography. Making of models and drawing will give accuracy in study and thought. The points to be emphasized in the study of the relief. The organism of the continent to be explained. The inferences to be drawn from a knowledge of the relief. The study of the plateaux, the hollows or basins, the passes, the plains and other surface-forms. The points to be emphasized in the teaching of the mountains. The snowline and its influence. The use of mountains to those in the locality. The influence of mountains on every aspect of the life of the people. Drainage. Natural function of the stream is drainage. Drainage, when most rapid and when slow and imperfect. The Ocean drainage. The River drainage. The Lake drainage.

PRACTICAL WORK

1. Drawing of syllabus for the teaching of the Relief of (1) Africa, (2) Eurasia, (3) North America, (4) South America or (5) India.
2. Making of Relief models.
3. Drawing the Physical maps of the Continents.

Lecture V

The teaching of Climate and Rainfall

Weather and Climate.—How far climate is determined by physical features.—Variation in the seasons.—Temperature.—Distribution of heat.—Zones.—Effect of heat on atmosphere, on land and on water.—Modification of heat by elevation.—Winds and their uses.—The Wind regions of the world.—Trade-wind and Anti-Trade-Wind Regions.—Winds as rain-bearers and heat-bearers.—Ocean currents and how heat is distributed by them.—The use of the Thermometer.—Temperature charts.—The working of mean averages.—Isotherms.—Construction of Isotherm maps for January and July from conditions given.—Pressure of air.—The use of the Barometer.—Barometric pressure and Altitude.—Isobars and Isobar charts.—Construction of Isobar maps from readings quoted in the meteorological reports.—Rainfall—How determined? Study of the rainfall map of the World.—Regions of heaviest rainfall, etc.—Rainfall in the interior and coastal regions.—Difference in the rainfall between the East and the West of certain continents.—The Rainfall of India.

PRACTICAL WORK

1. Drawing of syllabus for IV, V and VI Forms for the teaching of climate and rainfall of the continents or of India.
2. Preparing Isobar, Isothermal and Rainfall maps and graph charts.
3. Drawing maps to illustrate the rainfall of the various continents and India and representation of the same by means of graphs.

Lecture VI

Rivers and Lakes

The teaching of river basins.—The points to be stressed.—Water partings.—Continental and Oceanic rivers.—The action of the river on the surface.—The rivers drag the mountains down to the ocean.—Mountain sides are being scored with deep gorges.—Valleys are being levelled to allow alluvial plains.—Deltas are pushing their way to the sea.—The coast line and how it is being constantly changed by the action of the rivers.—Comparison of one river basin with that of another.—Difference between rivers of England and of India.—River Estuaries.—The uses of rivers—Manufacturing, Navigation, Irrigation, Fishing, Railway routes.—Lake Drainage. Inland Drainage—Where it naturally exists. The important inland drainages of the world. Mountain Lakes. Other kinds of Lakes.—Rivers, 'mortal enemies of Lakes.'—The influence of Lakes on Rivers flowing through them.

PRACTICAL WORK

1. Making of Relief models of river basins or of inland drainage and drawing maps to illustrate the river basins.
2. Drawing of syllabus for the teaching of the subject.

Lecture VII

The teaching of Products

Products :—Agricultural, Forest, Animal, and Mineral.—*Agricultural products* vary according to the character of the soil, temperature, moisture of air, duration of sunlight, situation and elevation.—Different kinds of soils.—Geology in elementary science.—School museums.—School gardens.—The pupils to infer the agricultural products from their previous knowledge of land features and climate.—Causes affecting the distribution of plant life.—The vegetation zones of the world. Conditions favourable for the growth of particular crops to be clearly explained before the pupils can make correct inferences.—Plants indigenous to a region and imported into it.—Certain agencies for importation.—Graphic representation of the products or yield per acre of different parts of a country and of different countries.—Means by which agriculture can be improved.—Occupations connected with agriculture in different regions of the World.

Forests :—Their chief home.—Conditions favourable for the growth of forests.—Tropical forests.—Temperate zone forests.—Occupations connected with forest products.

Animal products :—Conditions influencing the distribution of animals.—Relation of animals to plant life.—Areas of distribution of animals.—Characteristic animals of each of these realms.—Animals with a commercial value.—Horses, Camels, Elephants, Sheep and Goats, Cattle, Ostrich and fur-yielding animals.—Regions most favourable for these.—Pastoral products, such as butter, cheese, wool, hides and skins—Occupations connected with these.

Mineral Products :—The commercial value of coal, iron, etc.—Mountains, and minerals.—Occupations connected with minerals.—Material prosperity, how far dependant on mineral wealth?

PRACTICAL WORK

1. Drawing of Production maps.
2. Preparation of Graphic charts.
3. Preparation of syllabus for the teaching of the products of India, etc.

Lecture VIII

The teaching of Industries

Need for developing the natural resources of a country.—How far this development is dependent upon Geographical causes.—Geographical conditions which favour such development.—The Agricultural industry.—Grain-elevators.—The cotton industry.—The conditions which favour its development.—Towns which are centres of

cotton industry.—Industries connected with coal and iron.—Conditions favouring the progress of these—Growth of towns like Pittsburg.—Water-power, steam and electricity in the development of industries.—Mining towns.—Their wonderful development. Industries connected with the sea—Fisheries, sponges, etc.

PRACTICAL WORK

1. Drawing of syllabuses for the teaching of the industries of England, United States of America or of India.
2. Preparation of graphic charts re the growth of industries.

Lecture IX

Commerce and Geography

The importance of the subject.—The study of Geography as a factor in the development of the commerce of a country.—'Superior knowledge wins the race.'—Germany and America have clear advantages over England, because they pay greater attention to the study of Geography.—Influence of geographical conditions on man and his action upon them,—this, the foundation of all commerce.—The two great factors of every form of human activity.—How far man is able to modify geographical conditions, an interesting study.—The application of science,—steam, telegraph, cutting of canals, irrigation in arid deserts, etc.—The trade of England and of India.—Geography, 'a science of distances.'—How the distances are overcome.—The important trade routes, ocean, canal and rail routes.—The all-red route.—Harbours—When good and when bad.—Important harbours on the highways of commerce.—The Cable lines.

PRACTICAL WORK

1. Graphic representation of the trade of India and England.
2. Drawing of syllabus for the study of the commerce of any given country.
3. Drawing map of the World with trade routes, etc., marked.

Lecture X

History and Geography

The real meaning of History.—The Study of Geography indispensable to the Study of History.—Geography, one of the legs on which History stands.—Geography, how far indebted to History.—History of Ancient Greece and Rome and of Ancient India and how far they are the result of Geographical conditions.—Geographical conditions on the banks of the Nile, the Euphrates and the Tigris, the Ganges and the Indus, the Hoangho and Yang-tse-kiang and how these conditions favoured the growth of civilization in the Ancient world.—Comparison of these conditions with those prevailing on the banks of the Amazon and the Congo.—How far Geographical conditions influenced the History of England, of Holland, of the United States.—Distribution of population.—Characteristic features of the various races inhabiting the earth.—Geography and frontiers.—Geography and War.

PRACTICAL WORK

Drawing of Syllabus to show the relation between History and Geography of a given country.

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Lecture XI

Map and Map-making

The value of maps.—How maps are constructed.—The different kinds of map-projections.—The merits and defects of each of these projections.—The special purposes each projection is intended for.—Map drawing in the class-room.—Copying maps.—Memory maps.

PRACTICAL WORK

Drawing the different map-projections.

Lecture XII

Aids, Appliances and Reference books

A study of the replies given to the questions addressed to the Head Masters on Geography teaching.—Preparation of lists of Apparatus, Appliances, Reference books, etc.

Text-Books—Suggestions with reference to the selection of them. How to use them.

Geography Note-books. Geographical Curiosity Box. School Museums. School Gardens. Collection of pictures. The use of the Stereoscope in teaching Geography.—Geographical Journals.—Study of the Educational Catalogues.

PRACTICAL WORK

The use of the Magic lantern.
Magic Lantern Exhibition.

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University of Madras.

GEOGRAPHY

WHAT EMINENT MEN HAVE SAID OF IT

I. Geography is a branch of study whose final aim is to estimate the influences on man of terrestrial local conditions and place relations. [G. G. CHISHOLM.]

II. Geography contains elements of three things: of science, of art and of philosophy; of science, for it is reasoned, measured and ordered knowledge; of art—geography is half art, partly fine art; of philosophy, for the philosophies of history, politics and economics all contain a large geographical element. [H. J. MACKINDER.]

III. Geography is, on the one side, connected with the natural sciences such as physiography and on the other with the humanities such as history; for physiography investigates the great forces affecting the whole world; physical geography investigates the results of these forces as they are expressed in the distribution of land and water; while political geography throws light upon the action of these geographical results on human societies and *vice versa*, or as Mr. Mackinder puts it, 'Physiography asks of a given feature, Why is it? Physical geography, why is it there? Political geography, how does it act on man in society and how does he react on it. [BARNET.]

IV. Geography in one aspect or sense is the gateway to the physical sciences; in the second aspect it is the key to history and in the third it is the basis of commerce.

* * * * *

The aspects in which I regard the teaching of geography are perhaps rather fitter for a university or for advanced scholars than they are for a school. At the same time much may be done even in school for pupils between the ages of fourteen and sixteen. There is all the difference in the world between being 'elementary' and being 'superficial.' I believe even elementary knowledge may be made profitable provided that it is always given in close connexion with facts which the pupil can be taught to observe for himself and to reflect on for himself and not as a mere string of data to be carried in the memory.

* * * * *

If we have at the head of great businesses, of which there are so many in this country, men who have been thoroughly trained to observe these things and to look at them in a scientific way, you will have done a great deal towards helping us to maintain our place among the commercial nations of the world.

[RT. HON. JAMES BRYCE.]

V. 'A real knowledge of geography embraces at once a knowledge of the earth and of the dwellings of man upon it; it stretches out one hand to history, and the other to geology and physiology: it is just that part in the dominion of knowledge where the students of physical and of moral science meet together. Let me once understand the real geography of a country, its organic structure, if I may so call it; the

form of its skeleton, that is, of its hills; the magnitude of its veins and arteries, that is, of its streams and rivers; let me conceive of it as of a whole made up of connected parts; and then the position of man's dwellings, viewed in reference to these parts, becomes at once easily remembered, and lively and intelligible besides.' [DR. THOMAS ARNOLD.]

VI. 'The science which describes the surface of the earth, and its relations to the other members of the Solar system, deserves to be more accurately studied than is usually the case. We generally find modern geography neglected in schools, and ignored at Universities. It is one which must occupy a foremost place in any rational system of primary education. When the prejudices and traditions of our schools and schoolmasters have passed away—as they must pass away before a truer conception of the growth of a child's mind, and of the laws which govern that growth—the test of right teaching will be found in the correspondence of our instruction with the development of intellectual activity in those whom we instruct.' [J. R. GREEN.]

'In the days of our fathers the ancient classics were the common element in the culture of all men, a ground on which the specialists could meet. The world is changing and it would seem as if the classics were becoming a speciality. It is our duty to find a substitute. To me it seems that geography combines some of the requisite qualities. To the practical man, whether he aim at distinction in the state or the amassing of wealth, it is a store of invaluable information; to the student it is a stimulating basis from which to set out along a hundred special lines: to the teacher an implement for the calling out the powers of the intellect.' [H. J. MACKINDER.]

VII. 'Geography does not mean the miserable scraps of the modern school. Properly taught it embraces all that is essential for a cultivated man to know of the world of Nature, it gives life to history, and lays the sure foundation of commercial, industrial and political knowledge. It is because of its intellectual and moral effects chiefly that it claims a foremost place in the education of youth. There is probably no one subject so prolific of matter for independent thought and judgment on the affairs of life, and the destiny and duty of man. By means of it we extend the sympathies of the pupil and lay the foundation of that sentiment of humanity which is the necessary counterpoise to narrow and parochial prejudices. It tends to comprehensiveness of mind, to the correctness of hasty opinions, to the strengthening of patriotism, but at the same time to the moderation of insular insolence. It is a sworn foe to the prig. It widens intelligence and enriches the soul, furnishing nutrition to the ethical sentiments and a stimulus to the imagination.' [PROFESSOR LAURIE.]

VIII. 'Geography is a study of the earth as the home of man, hence we have two elements in the study of geography: the earth and man. In one extreme the study of geography is led toward pure physiography which is a branch of geology, on the other extreme toward sociology or history or some other branch of the study of man. Neither aspect of geography should, however, be studied for itself, but solely with reference to the relation of earth and man. The utilization of physiography in geography study is rational, well founded and scientific. If we are to have a study of the earth as the home of man we must have some familiarity with the earth. Physiography in the relation of the earth to man tells not merely the facts of importance, but the reasons as well, and helps in geography study to introduce the element of interest—an element sadly lacking in much geography work. Physiographic features determine the industrial, commercial and political aspects of a section of country. Knowing the climate and products of the United States one can predict with a considerable degree of certainty what occupations would be carried on in that country. Therefore physiography should be taught in a way that brings out this relationship. Make uses of causes in explaining effects of a geographic nature and you will make geography interesting. This is rational geographic teaching.' [PROF. RALPH S. TARR.]

IX. *The aims and relative importance of geography.*—The elevation of geography to the place which it ought to hold in the school curriculum appears to me a matter of vital moment; first from the value of the subject as a branch of knowledge; and secondly, because it offers a cure for what I conceive to be a radical defect in our educational method, namely, the want of any effective discipline in habits of observation. It may be begun on the very threshold of school-life, and may be pursued in ever-increasing fulness of detail and breadth of view up to the end of that time. No other subject can, for a moment, be compared with it in this respect. It serves as common ground on which the claims of literature, history and science may be reconciled. [ARCHIBALD GEIKIE.]

X. *The practical value of geography.*—'It is often supposed that while geography is very useful to the sailor, the soldier, the missionary, and the traveller, who have to go from place to place or to the merchant who has trading interests in distant lands, it has little concern with the life of the stay-at-home citizen. This is quite a mistake. Many of the interests of the present day are largely geographical and the daily paper acquires a fresh and fuller interest when it is read in this light. Even to know where the places one reads of are, what is their climate and how they are peopled is something; but, taking the wider view of geography as the science which aims at explaining, the adjustment of people to land, there is scarcely a problem of past history or of present politics and economics in any country which cannot be elucidated by the application of its principle. When it is once realized that geography is not merely a description of the immobile surface of the earth, but a comprehensive study of the influence which the lands, exercises on its people and of the reaction of the people on their own and on other lands, the value of the science and its practical utility will reveal themselves in many ways. Some may perhaps consider that geography is made to include too much, that it is made the centre and the circumference of Human knowledge; but this is simply an effect of perspective. Geography is not claimed to include the sciences whose results form its raw materials, any more than a house can be said to include the quarries, the forests and the mines which have yielded its stone and timber and metal work. [PROF. H. R. MILL.]

University of Madras.

Royal Geographical Society's Syllabuses of Instruction in Geography

In consequence of requests received from the London School Board and the Oxford and Cambridge School Examinations Board, the Council of the Royal Geographical Society appointed a special Committee to draw up syllabuses as guides to instruction in geography in elementary and in secondary schools. After careful consideration of the subject, the Committee requested the late Mr. T. G. Rooper, H. M. Inspector of Schools, and Mr. H. J. Mackinder, Reader in Geography at Oxford University, to draft the two syllabuses—the former that for elementary, and the latter that for higher schools. The sad death of Mr. Rooper deprived the Committee of his further valuable co-operation, and Mr. G. G. Chisholm consented to complete the revision of the elementary syllabus. The following is a very condensed outline of the syllabuses:

I. IN ELEMENTARY SCHOOLS

Geography has three main functions: (1) The determination or ascertainment, (2) the expression, and (3) the estimation or valuation of local conditions and place relations, that estimation or valuation having reference to the degree and extent of the influence which given local conditions and place relations exercise on other distributions, especially human distribution, and hence on the life of man generally. Directly or indirectly, human interests determine what it is most important to observe, and what, therefore, it is most important to set down in descriptions and on maps. This idea, therefore, should always be present in the mind of the teacher as a guide, not merely as to what he should endeavour most strongly to impress on the minds of the learners, but also as to what he should omit, so as not to overburden their memories or confuse their minds. In the earlier stages it is not necessary for children to know where they are being led; it is enough if what is imparted to them serves to put them on the right road.

a. Preliminary Stage

For Children between Five and Eight Years

At this stage children listen with eagerness to narratives of adventure by land and sea. For this purpose, it is best to make use of suitable extracts from books of famous travellers.

The readings should be accompanied by simple explanations of geographical terms used in the narratives, and descriptions illustrated by models, figures made with the aid of sand-trays, etc., and the children themselves should be practiced in modelling. But the teaching of geography at the first stage will have fulfilled its main purpose if it has been attractive, and has made the children think of other countries besides their own.

b. Foundation for Systematic Study

Children between Eight and Eleven Years old

It is a serious difficulty in geography that the mind has to deal with facts that cannot be directly observed. Hence arises the necessity for representing on a map the facts of Nature which are the real subject of study. It is important that the learner should realize—first, that geography is actually based on the observation of Nature, and, second, how the map is connected with such observations. It is of vital importance to lay a foundation for geographical teaching on the actual observations of the children themselves. This is what is referred to above as the first function of geography; but the third function, the estimating of the influence of local conditions and place relations chiefly on human life, will always be kept in view in telling children what to look at.

Geographical Observations within the Reach of Town Children

From the first children should be made familiar with the globe, which makes intelligible a number of observations which even town children can make for themselves, e.g., the apparent movements of the sun.

Town children, equally with country children, can acquire from their own observations the idea of direction, and can be shown how direction is represented on a map; for streets serve this purpose as well as roads. They can also be taught to understand, with the aid of their own observations, the importance and the mode of representing differences of elevation on maps; for most towns have sloping streets as well as level, or nearly level, streets. With the aid of their own observations they can be most easily taught to understand contour-lines.

Where there are rivers, the teacher can show how they prevent communication by land except where they are bridged. This shows them how water may hinder communication; but they can also learn at river banks or on ponds in town parks how water may also assist communication, and so get some idea of the advantages of rivers, seaports, and canals.

Many of the important changes which regularly or from time to time modify the value of local conditions, and even place relations, can also be observed in towns. Children can notice the rise of water and its rapid flow in gutters during heavy rains, and see how it is deposited in the streets when the rain is over. They know the difference between winter and summer, and could be made to observe that some plants do not thrive in cold summers, and that even in summer plants are apt to wither in droughts unless they are watered. They may, therefore, be taught that where both warmth and moisture are found vegetation is likely to be abundant and varied. They can learn from observation the advantages of a southerly aspect, and can be taught to observe the difference between cold and warm winds, and the advantage of shelter from cold winds.

Then town children know that things are bought in shops, and that some of these—eggs, milk, butter, flour, fruit—come from a distance; and even London gardens and parks may assist in giving them some idea of the different aspect presented by the districts in which such things are produced from that of the town in which they are sold.

Observations more easily made by Children in the Country

Children should learn to take the bearings of objects from the tops of hills, and to plot their observations on paper, aided by Ordnance maps of various scales. Great pains should be taken to get the children to understand the different degrees of generalization in the representation of the country on different scales. On the more comprehensive smaller scale maps parallels of latitude and meridians are, of course, marked, and the

practical use of a knowledge of latitude and longitude in indicating positions may be explained before the study of mathematical geography. With the aid of a contour map a relief model of the district may be constructed. The frequent attention, in the course of walks, to river banks and hillsides will lead to the observation of the flow of water, and the way in which rivers hollow out valleys, receive tributaries, and spread out mud into plains. Special attention should be called to such actions of rivers as tend to modify their value for man. On the one hand, the great fertility of flood-plains should be pointed out; but, on the other hand, children should be taught to notice that deposits make rivers shallower in different places, and thus made to understand why constant dredging is required to keep navigable channels clear.

Connected with the observation of wind, the formation of mist, cloud, and rain should be noted. Quarries and railway cuttings will reveal variation of soil. It should be pointed out that woods, scrub and marsh, grassy meadows, cultivated lands, and varied types of agriculture depend on configuration, soil, and local climate, and their position should be shown on the maps made by the children. There may also be opportunities to show the connexion between local conditions and other industries than agriculture. In some cases it may be found profitable to study, even at this stage, the parish boundaries with some care. Historical remains should, of course, be examined. Children should learn to trace the course of roads and railways from place to place, and to note where bridges are needed, where embankments, where steep gradients are avoided or necessitated, where 'saddles' in a range of hills form a pass, where roads are made to deviate in order to avoid steep gradients, or to reach the easiest saddle or the most convenient bridge; and on this part of the work great stress should be laid. Such information, if obtained first-hand, renders the description of foreign lands and their products subject for reasoning, not for mere memory.

Systematic Study of Geography with Maps as a Basis

In the study of maps the same ideas are to be emphasized as in observational work. Mountain and hill ranges should be considered first as hindrances to communication. It should be noted that where the country has varied surface features, the general slope of the land is more or less in accordance with the flow of the rivers, so that roads and railways run in much the same direction. The importance of rainfall and temperature with respect to agriculture, and of facilities for mining and manufactures, will not be overlooked. Even in the most elementary study of continents emphasis should be laid on the great facts that affect the distribution of population.

At this stage much use may be made of wall and lantern pictures, provided that they illustrate the value of local conditions or place relations.

c. Systematic Study of various parts of the World

Children from Eleven to Fourteen Years old

Additional observational work on convergence of traffic, and bridges.

In drawing up syllabuses for this stage it is not desirable to attempt to fix any hard and fast lines either as to the scope of the syllabus or the order of presentation; but it will be generally recognized that such a syllabus ought to provide at least for a general knowledge of the distribution of land and water, rainfall and temperature, and the main characteristics of the continents, and a more detailed knowledge of the United Kingdom, the more important parts of the British Empire, some of the countries of Western and Central Europe, and of the United States.

The important thing, however, is to note the main acts on which stress should be laid in the study of any of the regions mentioned. There should be a more detailed study of physical features, and of the importance of the lowest points and lines in mountainous and hilly country.

Boys and girls will now be better able to understand the laws affecting climate and learn to read physical maps; for instance, to note the effect of physical features on rainfall and on temperature. Climatic differences between our own country and other parts of the world should be emphasized, and, as far as possible, explained.

The study of the physical features with special reference to the means of communication will, in many cases, throw light on the position of towns, and afford the best means of fixing that position in the memory. It will lead to a better appreciation of the convergence of traffic at the mouths of great rivers.

Before they have reached the end of this stage boys and girls should be able to understand something of the influence which geographical conditions have exercised on history.

II. IN HIGHER SCHOOLS

It will lead to better results than are obtained at present if boys or girls be arranged in special sets for geography, as is now the custom for mathematics and certain other subjects.

The object of the teacher is to build up a conception of the surface of the earth as the product of interacting physical forces, in order that that surface may be intelligently viewed as the scene of social activities. It is therefore clear that the geographical teaching should be related to the teaching, on the one hand, of natural science, and on the other, of history. A frequent practice is to treat physical geography or physiography as an introduction to natural science, and for the rest to be content with the employment of atlases during the teaching of history. The result is that the two sides of the subject are not habitually connected in the mind of the pupil. The remedy probably lies in the teaching of geography, on a regional basis, with such a distribution of the physiographic explanations as shall not obliterate the regional interest. At every step in the treatment the learning of the topographical data, their physical analysis, and their application to the facts of human society, whether commercial, political, or historical, should be closely correlated.

It is suggested, by way of example, that the teaching of pupils in the four years between thirteen and seventeen might be arranged according to some such scheme as the following: In the first year, the study of a considerable portion of Britain, that surrounding the school; in the second year, the whole of Britain; in the third year, Europe, and perhaps the Mediterranean; in the fourth year, the remainder of the world. In each stage a comparison would constantly be made with that which preceded. The standards in treating of all Britain would be taken from the section of the country learned in detail, those for Europe would be taken from Britain, and those for the outer continents from Europe.

University of Madras.

Suggestions for the Improvement of Geography Teaching in Secondary Schools in the Madras Presidency

Time to be devoted to Geography Teaching

In the interest of Geography teaching it is desirable that at least four periods of 30/ in the primary classes, three periods of 45/ in Forms I, II and III and two periods of one hour each in the Forms IV, V and VI should be devoted to geography teaching.

Geography Teachers

The teaching of geography should be entrusted only to those teachers who have made a special study of the subject or have otherwise qualified themselves for it. As teachers who have made a special study of the subject are not many in number at present, Managers and Head Masters of Schools should afford every facility to teachers in their institution to specialize in the subject.

As far as practicable geography teaching of all the Upper Secondary forms should be entrusted only to one teacher.

It is also desirable that teachers of geography should not be entrusted with the teaching of more than two subjects of the school curricula (as History in addition to Geography or Science in addition to it). To secure efficiency in the teaching of the subject, the teacher should have the requisite time for the preparation of the lesson, the drawing of special maps and geographical charts, etc.

In the Lower Secondary forms it is desirable that all class work should be done by one teacher. But the geography teacher of the highest form in the school and the Head Master should exercise general supervision on the teaching of the subject in the lower forms. Such supervision will take the form of (1) giving instructions (a) for the preparation of general and detail syllabuses, (b) for the choice of text-books and of illustrations, (c) for the drawing of teachers' special maps and relief models, (2) giving occasionally model lessons in the lowest forms, and (3) setting or revision of Examination Papers.

Geography Syllabus

It is desirable that each class should have a separate syllabus for geography, prepared at the commencement of each year (or term). The syllabus should be progressive and to some extent 'concentric' in character. Geography might be advantageously commenced in the second standard with what is 'psychologically nearest' to the child, i.e., the telling of stories of the people and animals, fairs and festivals of India and of foreign lands. The stories should be illustrated with as many good pictures as possible. In the third standard the geography of what is 'physically nearest' to the child should be taught. The syllabus of these classes should be so arranged as to admit of 'slow development of the teaching of geography out of Nature Study.' As the foundation of geographical knowledge has to be laid in the lower classes, it is recommended that the utmost help should be rendered by the teachers in the higher

forms (to the teachers in the Primary Department) in the drawing up of the scheme of studies and of practically working it out. (*Vide* Instructions in the Syllabus of the Royal Geographical Society.)

It is further desirable that the present system of teaching geography by political divisions should be abandoned. Natural regions (for example, the Delta tracts, the plateaus, the mountainous regions) should be made the unit of geography study from the lower classes upwards, as this plan admits of better scientific treatment.

Mr. Herbertson's division of the world into its natural regions might for the present be adopted with advantage. (*Vide* Herbertson's Senior Oxford Geography.)

In the lower classes and in the Lower Secondary forms, the aim of the syllabus should be not to give many facts but to drive home again and again geographical principles from different points of view.

Correlation of Geography with other subjects

It is also desirable that Geography study should be correlated with the study of other subjects throughout the school course. The teachers of a school teaching different subjects might occasionally meet to discuss the question of how the subjects they teach are related to one another.

(E.g., Elementary Science can be given mainly a geographical aim as far as Form III. If the class teacher is the teacher of both these subjects, then this aim can be more easily realized, i.e., by applying elementary notions of air, water, vapour, etc., to physical geography.)

In the higher forms much history can be explained by geography especially political geography and campaigns. Literature, especially descriptive Literature, can be explained similarly by Geography.

Outline of lessons to be maintained by the Teacher

It is essential that the Geography teacher should keep with him brief notes of the lessons given to the class. Such notes should consist of a clear analysis of the portion studied, books consulted by the teacher, extracts from the books to be read to the class, reference to new books or magazine-articles published on the subject, the practical work to be done and suggestive questions. It is also essential that records of boys' daily class work in Geography as well as voluntary work in Map-drawing should be maintained.

Geography books in the Library

It is desirable that the School Library should contain a fair proportion of books on Geography. From time to time the Library should be improved by the addition of the most up-to-date books on the science of Geography. Books of travel and Geographical novels should find a place in the Library.

Teachers' Reference Library

Each school should make provision for a Teachers' Reference Library. It should contain books on the teaching of Geography, all good Textbooks on Geography, books of authority on the subject. (e.g., Mill's International Geography, Mackinder's Regional series of Geography, etc.) Educational and Geographical Magazines (*The School World*, *The Practical Teacher*, *The Geographical Teacher*, *The Geographical Journal*, etc.)

Aids and Appliances

The teacher will find himself helpless if he is not placed in possession of as many as possible of the following appliances:—

- (1) Relief model map of India.

- (2) Maps of the Continents, of India and of the British Isles, coloured not politically but physically (i.e., maps tinted according to elevation).
- (3) A large size globe physically coloured (if not a relief globe).
- (4) Map-building sheets of the continents and of India and crayons of different colours.
- (5) Hand diagram map sheets, Physical (Philips' or Johnston's).
- (6) As many sets of pictures as funds permit.

N.B.—Students and teachers might with advantage cultivate the useful habit of picture collection. Photographs and pictures may be collected in class albums.

- (7) Stereoscope and views of Geographical interest.
- (8) Magic Lantern and slides where funds permit.

N.B.—It is recommended that in the purchase of Geographical pictures, stereographs, Magic Lantern slides, groups of schools might form circles and exchange the views and slides.

Teachers might also avail themselves of the facilities afforded by the Educational Department. The Director of Public Instruction is collecting a series of excellent pictures of Geographical interest. They are being arranged and catalogued now and will in a short time be available for use by schools. The Inspectors of Schools lend Magic lantern slides to such schools as may apply for them.

Teachers' special Maps and Models

Teachers in the lower classes and forms should be encouraged

- (1) to construct relief models and draw contour lines;
- (2) to draw a large scale plan (e.g., 10 in. = 1 mile) of the village or town in which the school-house is situated;
- (3) to construct of brick and cement in a convenient place in the school compound (a) the large scale plan mentioned above, (b) a relief model of the Madras Presidency, (c) a relief model of India. The vertical and the horizontal scale in each case should be noted. Teachers in the forms of Secondary Schools should be encouraged to draw special maps to illustrate the relief of the country, river basins, isothermal lines for January and July, direction of winds, seasonal rainfall, vegetation; and to draw diagrams representing graphically the figures connected with rainfall, production, growth of industry and commerce.

N.B.—It will be necessary to make lists of maps graduated according to the nature of the matter to be introduced, the difficulty of treatment and the number of details to be dealt with.

Care should also be taken to avoid the danger of this sort of work becoming purely mechanical.

Maps in L'Estrange's Geography, Oxford Geography, Lyde's School Textbook of Geography, Snape's Geographical Diagrams, The Atlas of World's commerce, etc., might be developed for class use. World maps showing the natural regions, climatic zones, vegetation zones, etc., are very useful for the teaching of the subject in the lower forms. With a Head Master willing to supply the necessary materials, the Geography teachers of the school with the help of the Drawing Master and boys skilled in drawing can, in a short time, draw these maps.

School Museums

It is desirable that each school should have a Museum attached to it. Pupils should be encouraged to collect specimens of different kinds of soils and of rocks, agricultural, forest and mineral products, specimens to illustrate the various stages in the manufacture of raw materials, specimens of stamps, coins, etc. Special prizes

might be awarded each year to such of the students as make the best collection. Such specimens as the pupils cannot have access to, Head Masters are requested to purchase or otherwise obtain. In default of real objects, coloured pictures of them at least might be supplied.

Map Drawing

It should be made compulsory that pupils should bring with them to the class-room a good Atlas. The Atlas should contain some physical Maps, i.e., Maps tinted according to elevation.

Mapdrawing should, as far as possible, be done under the supervision of the teacher in the class-room itself and should be connected with the progress of the lesson from time to time. Pupils should always have with them in their geography class their Map-drawing books and crayons or pencils of different colours. Pupils may complete at home the maps they were started to draw in the class-room.

Practical Work

Practical work in connexion with Geography shall for the present consist in the

(a) *Lower forms* in (1) Construction of relief models, (2) Studying the weather charts, if not preparing them, (3) Striking averages with reference to temperature, rainfall, etc.

(b) *Higher forms* in (1) drawing Maps to illustrate the different geographical features, and (2) in graphic representation of figures.

School Excursions

It is desirable that children in the lower classes and forms should occasionally be taken out of the school-hours under the guidance of two or three of the most capable of Geography teachers for the purpose of studying the geographical features in the neighbourhood of the school. During these excursions children should be helped to observe for themselves as much as possible. The lessons in Geography for two or three periods subsequent to the excursion should be devoted to the construction of sketch maps and models of what the children observed and to the explanations of such maps and models.

Educational Exhibitions

Teachers and pupils in the various schools should be encouraged to send as many exhibits as possible from their schools to the various educational exhibitions that form such a pleasing feature of educational activity everywhere. The exhibits should consist not only of what is done specially for the exhibitions but also the daily work of the school.

University of Madras.

GEOGRAPHY

LIST OF BOOKS, MAPS, Etc.

Those marked with an asterisk are books, etc., whose purchase is recommended at the earliest opportunity.

Books on the Teaching of Geography

- * How to Study Geography : Francis W. Parker (Longmans) 6s. net.
- * The Teaching of Geography : A. Geikie (Macmillan & Co.), 2s.
- The Realistic Teaching of Geography : William Jolly (Blackie & Sons), 1s.
- Special Methods in Geography : M'Murry (Macmillan & Co.), 3/6.
- A New Basis of Geography : Redway (Macmillan & Co.), 5s.
- Child and Nature : Frye (Ginn & Co.).
- Plastic Method for Plastic Mind (Chapman and Hall), 1s. 6d.
- The Practical Teaching of Geography : Alexander Morgan (Philip and Son), 6d.
- * Hints on Teaching Geography : E. Young (Philip & Son), 6d. net.
- A Guide to Geographical Books and Appliances : Dr. A. J. Herbertson (Philip & Son).
- * Development of Geographical Teaching out of Nature Study. H. J. Mackinder (Philip & Son), 6d. net.
- Teachers' Manual of Methods in Geography : A. E. Frye (Ginn & Co.), 2/6.

Books for the selection of stories for Young Children

- Round the World : Ascott R. Hope (Blackie & Sons), 1s.
- Home and Abroad Readers, Books I and II (Edward Arnold), 10d. and 1s.
- Round the World. Tales of Travel (Jack), 10d. net.
- Little Folks of Many Lands (Ginn & Co.), 2s.
- The Little Cousin Series, Ward (Lock & Co.)

Books for the Lower Classes

FOR TEACHERS

- * Object Lessons in Geography : Dexter and Garlick (Longmans), 3/6.
- * Do. do. Murché (Macmillan).
- * Do. do. Shoesmith, 2s.
- Graphic Lessons in Physical and Astronomical Geography : Cowham, 4/6.
- This World of Ours : Arnold Forster. (Cassel), 2/6.
- Object Lessons in Geography and Science, Parts I, II and III. Frew (Blackie & Sons).

- Object Lessons in Geography and Science combined : Done and Tickner (Nelson), 2s.
- An Introduction to Practical Geography. Simmons and Richardson (Macmillan), 3/6
- Practical Geography, Part I, by J. F. Unstead, 1s. 6d. (Clarendon Press).
- Henderson's Primer of Practical Geography, 1s. 4d.
- * Davis's Practical Exercises in Physical Geography. (Ginn & Co.)

Books useful as Class Guides or Textbooks

(FOR PUPILS AND TEACHERS)

(1) LOWER CLASSES

- * Regional Geography (A. & C. Black)—
 - (a) World Pictures, 2s.
 - (b) Europe and the Mediterranean Region, 2s.
 - (c) The British Isles, 2s.
 - (d) The Americas, 2s.
 - (e) Asia.
- Lyde's Geography Readers.—7 books (A. & C. Black), 1s. 4d. each.
- Lyde's Elementary School Geography (A. & C. Black), 1s. 4d.
- * Preliminary Oxford Geography : Herbertson (Clarendon Press), 1/6.
- Elementary Studies in Geography : Mackinder (Philip & Son)—
 - * (a) Our Island Home, Parts I and II, 1s. 3d. each.
 - * (b) Land beyond the Channel, 1s. 9d.
- * Illustrated School Geography : A. J. Herbertson (Ginn & Co.), 5s.
- A First Geography : C. A. E. Rodgers (Blackie & Sons), 1s.
- Round the World Series of Geography Readers (Jack)—
 - Land and Water, 1s.
 - The British Isles, 1s. 4d.
 - Britain Beyond the Sea, 1s. 6d.
 - The World, 1s. 8d.
- * Our Planet.
- Macmillan's Globe Geography Readers : Murché—Introductory, Junior, and Intermediate.
- Longmans' New Geographical Readers. Standards I, II, V, VI (Longmans).
- Longmans' Pictorial Geography Readers, Nos. 1, 2, 3 and 4. (Longmans).
- Arnold's Geography Readers, Nos. I, II, III. (Edward Arnold).
- Round the World—A first Reader in Geography (Philip & Son), 6d.
- An Introduction to the study of Geography (Philip's Geographical Manuals), 1s.
- Home Geography and the Earth as a whole : Tarr and M'Murry (Macmillan), 3s.
- The World we live in (Blackie & Sons), 1/6.
- * The Round World. J. Fairgrieve, 1s. 4d. (A. & C. Black).

(2) HIGHER CLASSES

Oxford Geographies—

- * Junior : Herbertson, 2s.
- Senior : Herbertson, 2s. 6d.
- * Longmans' Geographical Series for India No. II. (Longmans), Rs. 1-8-0.
- Do. No. III. (Longmans), 4s. 6d.
- The World : Lyde. (A. & C. Black), 3s. 6d.
- School Textbook of Geography. Lyde (A. & C. Black), 3s. 6d.
- * L'Estrange's Progressive Course of Comparative Geography. (Philip & Son), 6s. net.
- * A Rational Geography : Earnest Young. Parts I, II and III, 1/6 each.
- General Geography : H. R. Mill. Macmillan & Co., 3s. 6d.
- Geography—Structural, Physical and Comparative. Gregory (Blackie & Sons), 5s.

- * A Scientific Geography, by E. W. Heaton (Ralph, Holland & Co.), 7 Parts.
 * Stephenson's Elements of Geography (Stanford) 3s. 6d.

Reference Books for High School Pupils

- * Descriptive Geography from Original sources. A. J. & H. D. Herbertson, 2s. 6d. each.
 Asia.
 Europe.
 Africa.
 N. America.
 Central and South America.
 Australia and Oceania.
 British Empire.
 Lyde's Geographical Readers.
 Macmillan's New Geography Readers, and Globe Geography Readers—Intermediate and Senior.
 Jack's Readers of the Continents (Round the World series).
 Chambers' Twentieth Century Geography Readers.
 Longmans' New Geography Readers. 9 vols. (Longmans).
 Longmans' Pictorial Geography Readers. 10 vols. (Longmans).
 The Illustrated Continental Geography Readers (Blackie & Sons).
 * A Survey of the British Empire (" ").
 Longmans' Geography for India, Burma and Ceylon; Chisholm. (Longmans) 3s. 6d.
 Nelson's World and Its people, 12 vol.
 * Man on the Earth, Lyde (Blackie), 2s.
 * Man and His Markets, Lyde (Macmillan), 2s.
 * Man and His Work, Herbertson (A. & C. Black).
 Man and His Dominion: Prothero (Methuen).
 The British Colonies and their industries: W. P. Gresswell (Philip), 1/6.
 The United States and their Industries, W. P. Gresswell (Philip), 1/6.
 Relations of Geography and History: George (Clarendon), 4/6.
 * Applied Geography, 1908 Edition: Scot Keltie (Philip), 2s. 6d.
 Development of Africa. Silva White (Philip), 7s. 6d.
 Visits to Remarkable places: W. Howitt (Longmans), 3/6.
 Workers under the Ground. Hartwig (Longmans), 2s.
 Wonders of the tropical forest. Hartwig (Longmans), 2s.
 Africa as seen by its explorers: E. J. Webb (Edward Arnold), 2s.
 Round the Empire. Parkin (Cassell).
 Our English Towns and Villages: (Blackie).
 Historical Geography of the British Colonies: (Lucas).
 Historical Geography of the British Empire: H. B. George (Methuen), 3s. 6d.
 Scenery of England and Switzerland. Averbury. Macmillan & Co.
 Kirth Johnston's Geography (Stanford).
 * Comparative Geography (Meiklejohn), 6s.

Indian Geography

- * Geography of the Indian Empire (Longmans), 6 As.
 * Morrison's Geography, Re. 1.
 India, Burma and Ceylon: Blandford (Macmillan), 2s.
 * Holdich: India (Clarendon Press), 7/6.
 * Imperial Gazetteer of India, vols. 1 & 3 (New Edition).

- Provincial Series, Madras, 2 vols., Rs. 6.
 Chapter on India in Chisholm's Geography for India and Ceylon, (Longmans), 3s. 6d.
 * Review of Indian Trade, issued annually by the Government of India.
 Report of the Geological Department of India.
 Murray's Guide to India, 20s.
 Forrest: Cities of India.
 W. S. Caine—Picturesque India.

Physical Geography

- J. Thornton: A Primer (Longmans), 2s.
 * C. R. Dryer: Lessons in Physical Geography (Philips), 6s. net.
 W. M. Davies: Physical Geography (Ginn & Co.)
 * R. S. Tarr: New Physical Geography (Macmillan), 4s. 6d.
 Outlines of Physiography; an Introduction to the Study of the Earth, A. J. Herbertson.
 Huxley: Physiography (Macmillan).
 Geikie: Physical Geography (Macmillan).
 A. J. Herbertson: Physiography (Arnold) 4s. 6d.
 Hugh's Physical Geography (Longmans, Green & Co.) 3s. 6d.

Commercial Geography

- Commercial Geography (Pitman and Sons).
 * The World's Commercial Products (Pitman & Sons), 10/6 net.
 G. G. Chisholm: Handbook of Commercial Geography (Longmans), 15s. net.
 * Do. A Smaller Handbook of Commercial Geography (Longmans), 3/6.
 John Yeats. The Golden Gates of Trade (Philip), 4/6.
 Do. Map studies of the Mercantile World (Philip), 4/6.
 Lyde's Commercial Geography (A. & C. Black).
 The World's Trade and Traders: Home and Abroad Readers (Edward Arnold), 1s. 6d.
 A. J. Herbertson: Commercial Geography (Chambers), 3s. 6d.
 Philips' Commercial Geography (Philips), 6s. net.

Books of Reference

FOR TEACHERS

- * Mill's International Geography (Newnes), 15s.
 Philip's Compendium of Geography with Index (Philip's), 10s. 6d.
 Regions of the World Series: G. Mackinder, 7/6 net—
 * Britain and the British Seas.
 Western Europe and the Mediterranean.
 Central Europe.
 The Near East.
 * India.
 The Farther East.
 North America.
 Prof. Geikie: Earth Sculpture (Murray), 6s. net (Progressive Science Series).
 I. C. Russell: River Development (") " (")
 C. E. Dutton: Earthquakes (") " (")
 Prof. Bonney: Volcanoes (") " (")
 „ Ward: Climate (") " (")

Realm of Nature: Mill (Murray), 5/.

* A. J. Herbertson: Distribution of Rainfall over all lands, 5/.

Handbook of Climatology.

* Blandford: Climate of India (Macmillan).

Jones: Types of Weather in Madras, Government Press, Calcutta.

Stanford's Compendium of Geography and Travels—

Keane: Asia, 2 Vols. (New Edition)

Dawson: N. America, Vol. I.

Gannett: N. America, Vol. II.

Keane: Africa, 2 vols.

Do. S. America, 2 vols.

Gregory: Australasia, Vol. I.

Guillemard: Australasia, Vol. II.

Chisholm: Europe, 2 vols.

Wallace: Malay Archipelago.

„ Geographical Distribution of animals.

„ Island Life.

W. E. Johnson: Mathematical Geography (Philip & Son) 5s. net.

Atlases

Newnes' Twentieth Century Citizen Atlas, 25s. net.

* Philips' Systematic Atlas, 15s. 6d.

Philips' Progressive Atlas of Comparative Geography. Ed. by P. H. L'Estrange, 3s. 6d. net.

Philips' Atlas of Physical Geography, 5s.

Longmans' New Atlas, 12s. 6d.

Newnes' Handy Shilling Atlas of the World, 1s. net.

Newnes' do. British Empire, 1s. net.

* Philips' Modern School Atlas of Comparative Geography, 3s. 6d.

Philips' Elementary Atlas of Comparative Geography, 1s.

Philips' Diagram Hand Atlas, 3s. net.

How to draw a map from memory. P. E. Swinstead (Blackie & Son).

Atlas of the World's Commerce (Newnes).

Geographical Diagrams: Snape (A. & C. Black).

Hand Atlas of India: Constable.

Historical and Modern Atlas of the British Empire, (Methuen).

International Student's Modern Atlas (Newnes), 6s.

* Maps and Map-drawing (Macmillan & Co.), by William Elderton, 1s.

Statistical Atlas of India: (Thacker & Co.), Rs. 5.

The British Empire and Japan (Bisiker), 16s. London Geographical Publishing Company.

Johnston's Indian Atlas (Macmillan).

Statistical Atlas of Madras Presidency.

Pictures

* Philips' Geographical illustrations (Coloured) 3/6 each. (About 52 in number.)

Pictures of Indian Plants, published by the Basel Mission, Calicut.

Royal Portfolio, Geography Series: Nelson.

Philips' Typical series of Educational Pictures, 1s. 3d. each.

The Queen's Empire: (Cassell & Co.), 9s.

The Deacon's London (Cassell & Co.), 10s. 6d.

A. Johnston's Series of Pictures.

Views of India, published by the 'Times of India.'

Indian Pictures of the C. L. Society, Madras.

Pictorial Tour of the World, etc.: (Warne & Co.).

Six Weeks in the Mediterranean: (Philip & Sons), 1s. net.

Glimpses of India (William Watson & Co., Bombay).

Philips' Coloured Pictures at 1/3 each or a set of 24 per 20s.

The Nation's Pictures (Cassell & Co.).

Living Races of Mankind.

Arnold's Geography Pictures (Coloured), (Edward Arnold), 1s. 6d. net each.

Perry Pictures, Geographical Series.

Tuck's Picture Post Cards, Geographical Series.

Pictorial England and Wales: (Cassell), 10s. 6d.

Pictorial New Zealand: (Cassell), 6s.

List of Appliances, etc.

GLOBES.

Philips' Relief Globe, 12 inches diameter, Physical, Rs. 45.

Philips' Physical School Globes. (Land tinted according to elevation). From Rs. 20 upwards.

Philips' Vernacular Globes, Tamil and Telugu (for III & IV classes), Rs. 6.

TELLURIAN.

Philips' English Tellurian, Rs. 56.

Philips' New School Tellurian, Rs. 35.

N.B.—Some geographers do not believe in the use of the Tellurian. But if its mechanism is complete as in the case of Philips' New Tellurian (Rs. 142 and Rs. 565), its use is not so objectionable.

Relief Model Maps.—

Philips' India, Rs. 24.

Bacon's or Macmillans'.

N.B.—Teachers should be encouraged to construct relief models for the use of their schools.

MATERIALS.

(a) Chalk powder and Linseed Oil (అవ్వ, అప్పిమ్).

(b) 'Soak coarse brown paper for two or three days until it becomes a pulp. Take an ordinary school slate and rub the surface with blue pencil or chalk. Next lay the pulp over the slate fairly thickly. By using a slate pencil the pulp may be picked up into mountains, scratched out for bays and rivers.'

(c) Plaster of Paris.

(d) Tamarind seed gum.

Large size Relief Model Maps of India, the Madras Presidency, and a plan of the town or village in which the school is situated might be constructed of brick and cement in a convenient place in the School compound.

The vertical and horizontal scales to be clearly noted in each case.

Please refer to the instructions on the subject given in Parker's 'How to study Geography.' Teachers might with advantage study 'Map Modeling in Geography' by Dr. A. E. Maltby. E. L. Keelog & Co., New York.

Maps

Maps coloured according to political boundaries should be avoided as much as possible. Those coloured physically are most useful for teaching purposes.

1. Philips' Comparative series of Large School-room Maps:—
The World and the Continents, 18s. each.
Indian Empire, 14s.
British Isles, 16s.
2. Philips' Large Physical Wall Maps, 30s. or 28s.
('These Maps have all the appearance of a map in relief.')
3. Stanford's New Orographical Maps, 20s. each.
4. W. and A. K. Johnston's Bathy-orographical Wall Maps.
5. Nelson Royal Wall Atlases.

Map-building Sheets

Philips'—Single sheet, 1s. 6d.

The Continents, 6 Maps, 9s. net.

The British Possessions, 6 Maps, 9s. net.

Handbook containing specimen lessons and hints on method, to accompany the above sheet, 4d. each.

Longmans' Indian Map Building Sheets. (7 Maps) at Re. 1 each.

Outline Maps for Pupils

The Autograph one penny Outline Maps, Oxford Geographical Institute.

The Diagram Outline Maps—(Philip & Sons), 1d. each.

'A very valuable series for the proper appreciation of watersheds and drainage areas.

Miscellaneous

Cox & Co.'s Object Lesson Cards, 2/6 net each card.

Teachers and Students should be encouraged to collect specimens of objects of Geographical interest for the School Museum.

School-gardens; they should contain rare plants not grown in the vicinity of the School-house. It is far better to encourage pupils to grow them.

Stereoscope, 4/6 each.

Stereographs, 9d. each. Underwood, 104 High Holborn, London, W.C.

Magic Lantern and Slides;—

The Inspectors of Schools lend sides to the schools in their circle.

Pictures of the Art Loan Collection, Office of the Director of Public Instruction.

Thermometer, Barometer, Angle Meter (2s. 9d.) Vane, Rain gauge, Daily Weather Chart issued by the Meteorological Department or their reproduction in the Newspapers.

Reynolds and Branson (Leeds) sell a complete set of Meteorological apparatus for Educational purposes for £2-5-0.

N.B.—Pupils must be trained to study the weather charts; to construct charts with the conditions given.

Journal and Periodical Publications

The Geographical Teacher—The Organ of the Geographical Association. Edited by A. J. Herbertson (Longmans), Rs. 3 per annum.

The Journal of Geography—(An American Journal for Teachers). About Rs. 4 per annum—Teachers' College, Columbia University—New York City.

The Geographical Journal—The Organ of the Royal Geographical Association, contains original records of the most recent travel, and the fullest monthly bibliography and list of Maps.

The University Library in the Madras Museum contains the monthly number of this Journal.

The Scottish Geographical Magazine—Published by the Royal Geographical Society of Edinburgh.

The Statesman's Year Book. Edited by Scott Keltie. 10/6, Macmillan & Co.

The 'Daily Mail' Year Book, 1s. 6d.

Statistical Abstract for the United Kingdom, 1s. 3d.

Do. for India.

Do. for the British Empire.

The Census Reports.

The Trade Journal of India.

The Agricultural Journal of India.

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Scheme for Practical work in connexion with the University Lectures on History Teaching

1. Drafting a syllabus of local History (district, taluq or town) for use in the highest class of the primary grade—the syllabus to be brought ready by the teachers and to be discussed.
2. Drafting a syllabus similarly for forms I and II of the elementary school grade—(Stories from Indian History) (teachers to come prepared but the syllabus to be drawn up and discussed in the lecture centre).
3. Drawing up a syllabus for form III (Indian History—elementary knowledge of the whole). Discussion.
4. Selection of illustrative matter for the above. Discussion.
5. Adjustment of the University Syllabus in English History and Indian History between the three High School Classes. Schemes and discussion.
6. Selection of illustrative matter, supplementary reading and of excerpts from standard works and sources for the above.
7. Exercise in drawing maps, charts, plans and graphs.
8. Exercise in question-paper setting. Discussion.
9. Drawing up lists of apparatus, appliances, books and aids to History teaching generally for school and form libraries.
10. Explanation (and exhibition) of the different apparatus, appliances and aids for History teaching.
11. Lesson Notes by (a) the topical method, (b) and the chronological method—Exercise in framing such notes. Discussion of the 'Notes.'

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University of Madras.

Syllabus of Lectures on the Principles and Methods of History Teaching

Introductory

The present state of History teaching in our schools.
The consequences of indifference, ignorance and absence of method.
Examinations and their bearing on Educational values.
Absence of tradition and discouragement; their results on History teaching.
Need for reconsideration.

The Character and Scope of History

The meaning of History. Its scope and content. Relation of History to other subjects. Is History a Science? Unity and continuity of History. History as literature. The divisions of Historical study—discussion of their nature and educational value.

The Uses of Historical Study and the Aims of History Teaching

Comparative educational values of subjects of study. Content and Method. The uses of Historical study.

The place of History in Educational schemes and school curricula—ideal and actual.

The question of correlation. History in the time-tables and in examinations.

The general aims of History teaching: the goal to be attained.

Special aims—and how they are met. General History—Local History—History of own and foreign countries. Ancient History, Modern History and Contemporary History. Large fields and narrow. Study from sources.

Methods of Historical Study and Teaching

The bearing of the Character, content and aim of History on the question of method.

Connexion between Methods of study and research and teaching Methods.

Description of chief methods of teaching—the concentric and periodic systems—their merits, fitness to standards and limitations.

Biographical treatment; topical treatment.

Heuristic Methods—their place in History teaching: the tracing of broad movements.

Study of details—its merits and defects.

Study from sources—its value and secondary education.

A controverted question—the value of mere stories as a prelude to Historical study.

Conditions of Good History Teaching

Enumeration: preliminary discussion of their relative importance.

Discussion in detail

(a) THE LOCALITY—value of tradition in stimulating interest in History. Bearing on choice of periods for class study: utilization of local antiquities in teaching.

(b) THE PUPILS—their previous equipment—inherited 'historic sense'—Selection of teaching method and topics to suit age, sex, standard, religion and environment. Home influences.

(c) THE CURRICULUM—harmonious co-ordination of subjects and courses. Features of good Curricula and of bad. Curricula and examinations.

(d) THE TEACHER—qualifications desirable and undesirable—variation according to standard and subject matter; general training and special training. Need for teacher's reading and constant self-improvement; and for teacher's preparation;

Administrative exigencies and teacher's efficiency—questions of salary, leisure, scope for recreation and reading and for exercise of individuality.

(e) METHOD OF TEACHING—the selection of appropriate methods. Need to make provision for uniformity without sacrificing individuality. Discussion generally of methods appropriate to particular grades.

(f) SCHOOL EQUIPMENT—Books—illustrative material—appliances and apparatus—provision for excursions—Suggestions and hints regarding these. A plea for a history room in schools. Seminar work in higher schools.

(g) TIME AVAILABLE—waste and how to avoid it. Correlation—its uses. Syllabuses of Courses and programme of works for the year: need to make provision for class work, preparation (teacher's and pupil's) and home-work.

(h) PRESENTATION—(ACTUAL TEACHING).

1. Textbooks—merits and demerits of using them in the different standards.

How to choose textbooks. Supplementary reading—Readers, History books, Sources—pupil's written work.

'Notes' and the blackboard to supplement textbooks.

How to use textbooks, e.g., concrete examples from English and Indian History.

Teacher's need for mastery of textbooks used.

The suggestions of experience.

2. Oral Instruction—Its place in the various standards and subjects—Training required. Natural gifts—How to make up for deficiency of such gifts.

Difficulties of oral teaching—choice of language and of examples—need for preparation and spontaneity—practical suggestions—use of the blackboard in oral teaching. Dramatic narrative.

How to tell a story well in the primary classes.

3. Questioning—Its objects and dangers. Practical suggestions.

4. Teaching and lecturing—Reference to standard—'Notes'—Practical suggestions. Preaching and teaching.

5. Facts, their selection and organization—What to select and what to omit in relation to standard, and intrinsic value. Organization of facts in relation to time, place and causation.

(a) TIME RELATIONS—(CHRONOLOGY)—necessity of pupils grasping the idea of time—(Withers' line of time—Synchronism tables—time-maps).

Dates and names—their use and abuse; how many and what to be taught in the several classes. How to teach dates.

(b) (PLACE RELATIONS—HISTORY AND GEOGRAPHY—man and environment—the influence of physical conditions; and of human (heredity, society and organization).

Climate and national character. The importance of physical causes in Indian and English History—Illustrations.

(c) CAUSE AND EFFECT GENERALLY IN HISTORY—

The conceptions of historical law and order.

The interdependence of events—history of four dimensions.

The interpretation and connexion of facts. The lessons of History—The political value of History. Examples.

6. Aids and stimuli.

(a) WORD-PAINTING—the use of the imagination—(value of picturing the dead coming alive once a hundred years or so)—Historical fiction—Its use and abuse. Idealized Historical pictures.

(b) BALLADS AND RECITATIONS—Music lessons and History—how far possible in local conditions.

(c) HISTORY AND MANUAL WORK—drawing: painting: modelling: making casts: dressing dolls in girls' schools: living pictures—tableau—historical drama.

(d) APPEAL TO PUPIL'S JUDGMENT—The pleasures of awakening criticism—the use of sources and 'purple patches' from standard authors.

(e) OTHER USES OF SOURCES—filling up details: added picturesqueness: insight into contemporary views.

(f) MAPS—historical and geographical—various kinds: transparent and graphical: contemporary maps—their importance.

(g) GRAPHS—their use and abuse. Practical suggestions.

(h) DIAGRAMMATIC REPRESENTATIONS OF HISTORY—Charts, plans of battles, and sites, genealogical tables.

(i) PHOTOGRAPHS—of sites, monuments, antiquarian objects, etc. Pictures—literal and imaginative. Advice as to their selection and use. Cautions.

(j) SCHOOL PORTFOLIOS:—students' albums: stamp and postcard collections. Coins and antiquarian objects generally.

Object Lessons in History—School Museums.

(k) LINES OF TIME:—historical calendars, historical anniversaries, and celebrations.

(l) THE HISTORY NOTICE BOARD—the school-chronicle and school 'annals of the time.'

(m) SUPPLEMENTARY READING—Collateral reading—fiction and sources.

(n) THE MAGIC LANTERN—Cinematograph exhibitions.

(o) SCHOOL DEBATES—previous training of pupils—part of teachers in such debates.

(p) HISTORICAL EXCURSIONS—their use and organization—hints—cautions.

(q) WRITTEN WORK IN HISTORY—Biography writing: essay writing: points to secure in these. Correction of written work and discussion.

(r) SUBJECT LESSONS.

7. Recapitulation—(a) by pupils, (b) by the teacher—its uses.

Summaries by (a) the pupils, and (b) the teacher.

The blackboard—its uses, for this and for other purposes in History teaching.

8. (Examinations)—

Their purpose, and number; use and abuse. What to ask in question papers and what not to ask in them.

How to value them.

Suggestions and discussion.

The Teaching of History in other Countries

England, Germany, France, America, and Japan. Their lessons for us.

The Teaching of Civics

Relations of History to Civics. The value of public life to Historians; why should civics be taught?

Character of first lessons in civics.

Importance of studying local administration.

Study of practical politics.

Comparative politics.

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Selection of History Books recommended for the Teachers' Reference Library of a good Secondary School

N.B.—The asterisked are relatively optional.

Bibliography

General History—* Adams' 'Manual of Historical Literature' (Harper).
English History: Gardiner and Mullinger—'Introduction to English History' (Kegan Paul).

See also Select List in the Student's Gardiner and Tout's Advanced History.

Indian History.
Bibliographical Appendix to Buckland's 'Dictionary of Indian Biography' (Sonnenschein).—(for the 'Modern' period). Keene's 'History of India,' 2 vols., Grant), Sir W. Hunter's 'Brief History of the Indian Peoples' (ed. Hutton), and the 'Historical' volume of the revised 'Indian Empire' contain select lists of references to sources and standard works. See also the very full references in Duff's Chronology of India' (Constable). **Local History**—For References see the revised 'Imperial Gazetteer of India' and the revised 'Madras Gazetteers.'

General

Grant ...	... Outlines of European History. (Longmans).
Thatcher and Schwill	... Medieval and Modern Europe. (Murray).
Rawlinson	... Ancient History. (Clarendon Press).
* Doyle ...	... History of America. (Macmillan).
Goldwin Smith	... History of America.
Lodge ...	... Modern Europe.
George ...	... Relations between Geography and History.
* George ...	... Genealogical Tables.
George ...	... Historical Geography of the British Empire.
General Historical Atlas	... (Putzger, Colbeck or Dow).
Grant ...	... Introduction to English Historians (Blackie).

English History

* Hunt and Poole ...	... 'Political History of England' (12 vols., Longmans).
* Oman ...	... 'History of England' (6 vols., Methuen).
Colby ...	... Sources of English History.
Black ...	... English History from original sources.
Coman and Kendall	... Source book of English History.
Beard ...	... Introduction to the English Historians.
Langmead ...	... English Constitutional History.
* Maitland ...	... Lectures on English Constitutional History.
Low and Pulling ...	... Dictionary of English History.
* Selections of English Documents	by Adams and Stephens, Prothero, Gardiner and Grant Robertson.

- Green ... Short History of the English People (illustrated edition).
- Bateson ... Medieval England.
- Warner ... Outlines of English Industrial History.
- English History from contemporary writers. (Nutt).
- * Barnard ... A Companion to English History in the Early and Middle Ages.
- Gardiner ... Atlas of English History.
- Robertson ... Do.
- Emile Reich ... Atlas.
- George ... Battles of English History.
- Biographies and Epochs ... Select volumes from Twelve English Statesmen series, English Men of Action series, English Worthies series, Heroes of Nations series, Epochs of Modern History.
- * Seeley ... Growth of British Policy.
- Wakeman ... Short History of the English Church (Rivington).
- * Traill and Mann ... Social England.

Indian History

- * Ragozin ... Vedic India.
- Macdonnell ... History of Sanskrit Literature.
- Rhys Davids ... Buddhism and Buddhist India (S.P.C.K.)
- * Hopkins ... Religions of India.
- Oman ... The Great Epics of India.
- Vincent Smith ... Early History of India.
- Bhandarkar ... 'Early History of the Dekhan' and 'A Peep into the Early History of India' (J.B.B.R.A.S).
- * Rapson ... Indian Coins.
- * Grunwedell and Burgess ... Buddhist Art in India.
- * Fergusson and Burgess ... History of Indian and Eastern Architecture.
- * Grierson ... Sketch of the History of the Vernacular Literatures of Hindustan.
- Duff ... Chronology of India. (Constable).
- * Frazer ... Literary History of India.
- * Elphinstone ... History of India (ed. Cowell).
- Lane Poole ... Medieval India.
- * Keene ... Fall of the Mughal Empire.
- * Owen ... India on the Eve of the British Conquest.
- Ranade ... 'Rise of the Maratha Power' and * 'Introduction to the Peshwas, and the Satara Rajas' Diaries.
- * Grant Duff ... History of the Marathas.
- Rulers of India Series* ... (Select volumes) or the Abridged Edition.
- * Whiteaway ... Rise of the Portuguese Power in India.
- * Malleson ... History of the French in India.
- Frazer ... British India.
- * Hunter ... History of British India (Vols. I and II.)
- Lyall ... Rise and Expansion of British Dominion in India.
- Seeley ... The Expansion of England.
- Gordon ... The Sikhs.
- Cunningham ... History of the Sikhs.

- * Gribble ... History of the Deccan.
- Sewell ... A Forgotten Empire.
- Forrest ... The Administration of Warren Hastings.
- Lee Warner ... Protected Princes of India.
- * Elliot and Dowson ... History of India (8 vols.)
- Buckland ... Dictionary of Indian Biography.
- Beale ... Oriental Biographical Dictionary.
- Imperial Gazetteer of India (4 vols. The Indian Empire.)
- Madras Provincial Gazetteer (2 vols.)
- Civilization in Ancient India ... R. C. Dutt.
- Malleson ... Decisive Battles of India.
- Do. ... Founders of the Indian Empire.
- Chesney ... Indian Polity.
- Malleson ... Native States.
- Todd ... Annals of Rajasthan.
- Men of Action Series ... Select volumes.
- Picturesque India ... W. S. Caine.
- India Pictorial and Descriptive.
- Cassell's Illustrated History of India (2 vols.)
- Report on Madras Census (1901) (4 vols.)
- India in the Victorian Era } ... R. C. Dutt.
- Economic History of India. }

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Syllabus of Stories from Indian History

1. The great king Sudas.
2. Janaka's wisdom.
3. The story of the Buddha.
4. Alexander.
5. How Hindustan came under one umbrella.
6. A royal Monk.
7. Pushyamitra's sacrifice.
8. A Conqueror of Worlds.
9. A royal Scholar.
10. The great Reformer.
11. A great South Indian King.
12. The birth of a Creed.
13. The romance of an invasion.
14. A fatal Swayamvara.
15. A royal Fakir.
16. The World-Conqueror.
17. A tragedy of talent.
18. The Father of his subjects.
19. A strenuous life.
20. The rout at Talikota.
21. A Model King.
22. The Splendour of an Empire.
23. A self-defeated ambition.
24. The birth of a nation.
25. An Empire on the breakers.
26. An adventurous Sailor.
27. The sowing of the Seed.
28. A night of horrors.
29. A Captain of the Wars.
30. A House divided against itself.
31. The trials of a Statesman.
32. A Freebooter on the throne.
33. An unrealized ambition.
34. The Tiger of Mysore.
35. The Great Pro-consul.
36. The Lion of Lahore.
37. The victories of peace.
38. The romance of the Koh-i-noor.
39. A masterless legion.
40. The winning of the East.
41. The coming of the Great Queen.
42. A noble's life's work.

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INDIAN HISTORICAL TALES

Author	Title	Subject
H. H. Wilson (tr.)	... Mudrarakshasa	... Chandragupta Maurya.
Ryder (tr.)	... The Little Clay Cart	... Social Life, Third Century B.C.
H. H. Wilson (tr.)	... Malavikagnimitra	... Pushyamitra Sunga.
Mrs. Besant	... Children of the Motherland.	(Various.)
M. Macmillan	... Tales of Indian Chivalry	... Muhammadan and Maratha Periods.
G. Festing	... In the Land of Princes	... Stories of Rajputs.
R. C. Dutt	... Bimala or The Dewan's Akbar.	(Tamil tr. by Mr. R. Daughter.
Do.	... Akbar	... Akbar's conquest of Kashmir-Court at Fattehpur Sikri. (Malayalam tr. by Kerala Varma.)
M. Taylor	... Tara	... Sivaji (1657).
M. Taylor	... The Noble Queen	... Chand Bibi of Ahmadnagar.
M. Macmillan	... In Wild Maratha Battle	... Sivaji
Sidney Grier	... In Farthest Ind	... 1664—1685. The Inquisition at Goa and the Court of the Great Mughal.
M. Macmillan	... The Princess of Balkh	... Aurangzeb.
G. A. Henty	... With Clive in India	... 1751—1757.
Sidney Grier	... Like another Helen	... 1755—1757. The Black Hole Tragedy.
M. Taylor	... Ralph Darnell	... 1757. Plassey.
H. Compton	... A Free Lance in a Far Land.	Late 18th Century—Hindustan.
Sir Walter Scott	... The Surgeon's Daughter	... India 1780 (Mysore).
M. Taylor	... Tippoo Sultan	... 1788—1799.
G. A. Henty	... The Tiger of Mysore	... 1799.
Sir Bartle Frere (Ed.)	... Pandurang Hari	... The Marathas—early 19th Century.
G. A. Henty	... At the Point of the Bayonet	Assaye.
E. F. Pollard	... The Silver Hand	... Sindhia's Wars.
M. Macmillan	... The Last of the Peshwas	... Last Maratha War.
G. A. Henty	... On the Irrawaddy	... First Burmese War.
G. A. Henty	... From Herat to Cabul	... 1836—1838.
M. Taylor	... Confessions of a Thug	... Thuggee and Dacoity.
G. A. Henty	... Through the Sikh Wars	
Sir George Chesney	... The Dilemma	... 1857. The Mutiny.
R. E. Forrest	... For Eight Days	... Siege of Delhi—1857.
A. W. P. Harcourt	... Jenetha's Venture	... Siege of Delhi—1857.
G. A. Henty	... Ranjub the Juggler	... The Mutiny.
F. A. Steel	... On the Face of the Waters.	Siege of Delhi—1857.
M. Taylor	... Seeta	... The Mutiny—1857.
Sir H. M. Durand	... Helen Trevelyn	... 1877—1880 Second Afghan War.
G. A. Henty	... For Name and Fame	... 1877—1880 Second Afghan War.

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Select List of Historical Novels bearing on English History since the Conquest

Title	Author	Publisher	Period covered
Harold	... Lytton	... Geo. Routledge	... Norman Conquest, Harold-William I.
Hereward the Wake	... Charles Kingsley	... Macmillan	... Norman Conquest, Harold-William I.
Wulf the Saxon	... Henty	... Blackie	... Norman Conquest, Harold-William I.
In the Days of St. Anselm.	Hollis	... Society for Promoting Christian Knowledge.	William II.
The Legend of Reading Abbey.	Macfarlane	... Constable	... Stephen.
The Betrothed	... Scott	... Black	... Henry II.
The Talisman	... Scott	... Black	... Richard I.
Ivanhoe	... Scott	... Black	... Richard I.
Runnymede and Lincoln Fair.	Edger	... Ward, Lock	... John.
A Stout English Bowman.	Pickering	... Blackie	... Henry III.
How I Won My Spurs...	Edger	... Ward, Lock	... Henry III.
The King's Reeve	... Gilliat	... Seeley	... Edward I.
In Freedom's Cause	... Henty	... Blackie	... Wallace and Bruce, Edward I-Edward II.
The Chevalier of the Splendid Crest.	Sir Herbert Max-well.	Blackwood	... Wallace and Bruce, Edward I-Edward II.
The White Company	... Conan Doyle	... Smith, Elder	... Edward III.
The Lances of Lynwood.	Charlotte M. Yonge.	Macmillan	... Edward III.
Crecy and Poitiers	... Edger	... Ward, Lock	... Edward III.
St. George for England.	Henty	... Blackie	... Edward III.
A March on London	... Henty	... Blackie	... Edward III.
Both Sides of the Border.	Henty	... Blackie	... Henry IV.
In the Days of Prince Hal.	Elrington	... Blackie	... Henry V.
At Agincourt	... Henty	... Blackie	... Henry V.
Agincourt	... James	... Warne	... Henry V.

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Title	Author	Publisher	Period covered
The Last of the Barons.	Lytton	... Geo. Routledge	... Wars of the Roses, Henry VI-Edward IV.
The Black Arrow	... Stevenson	... Cassell	... Wars of the Roses, Henry VI-Edward IV.
The Chantry Priest of Church Barnet.		... Seeley	... Wars of the Roses, Henry VI-Edward IV.
The Woodman	... James	... Warne	... Richard III.
The Heir of Hascombe Hall.	Everett Green	... Nelson	... Henry VII.
Windsor Castle	... Harrison Ainsworth.	Geo. Routledge	... Henry VIII.
Privy Seal	... Hueffer	...	... Henry VIII.
The Armourer's Tices.	Pren-Charlotte M. Yonge.	Macmillan	... Henry VIII.
The Tower of London...	Harrison Ainsworth.	Geo. Routledge	... Mary.
Kenilworth	... Scott	... Black	... Elizabeth.
Westward Ho!	... Charles Kingsley	... Macmillan	... Elizabeth.
The Fortunes of Nigel...	Scott	... Black	... James I.
Holmby House	... Whyte Melville	... Ward, Lock	... Charles I.
The Splendid Spur	... 'Q'	... Cassell	... Charles I.
With the King at Oxford.	Church	... Seeley	... Charles I.
Woodstock	... Scott	... Black	... Commonwealth.
Captain Jacobus	... Cope Cornford	... Methuen	... Commonwealth.
Old St. Paul's	... Harrison Ainsworth.	Geo. Routledge	... Charles II.
Traitor or Patriot?	... Rowsell	... Blackie	... Charles II.
Silas Verney	... Edger Pickering	... Blackie	... Charles II.
Old Mortality	... Scott	... Black	... Charles II.
Lorna Doone	... Blackmore	... Sampson Low	... James II.
Micah Clarke	... Conan Doyle	... Longmans, Green	... James II.
For Faith and Freedom.	Walter Besant	... Chatto and Windus...	... James II.
Blue Pavilions	... 'Q'	... Cassell	... William III.
Shrewsbury	... Stanley Weyman	...	... William III.
The Cornet of Horse	... Henty	... Sampson Low	... Anne.
The Bravest of the Brave.	the Henty	... Blackie	... Anne.
Rob Roy	... Scott	... Black	... George I.
Dorothy Forster	... Besant	... Chatto and Windus...	... George I.
The Miser's Daughter	... Harrison Ainsworth.	Geo. Routledge	... George II.
Waverley	... Scott	... Black	... George II.
Kidnapped	... Stevenson	... Cassell	... George II.
Catriona	... Stevenson	... Cassell	... George II.
The Castle Inn	... Stanley Weyman	...	... George II.
Barnaby Rudge	... Charles Dickens	... Chapman and Hall...	... George III.
In Press-Gang Days	... Pickering	... Warne	... George III.
At the Point of the Bayonet.	Henty	... Blackie	... George III.
With Moore at Corunna.	Henty	... Blackie	... George III.
Under Wellington's Command.		...	...

Title	Author	Publisher	Period covered
One of the 28th	... Henty	... Blackie	... George III.
A Gallant Grenadier	... Captain Brereton	... Sampson Low	... Indian Mutiny.
A Clerk of Oxford	... Everett Green	... Nelson	... Henry III.
The Household of Man- ning Sir Thomas More.	... Nimmo	...	... Henry VIII.
Unknown to History	... Charlotte M. Yonge.	Macmillan	... Elizabeth.
After Worcester	... Everett Green	... Nelson	... Commonwealth.
In Taunton Town	... Everett Green	... Nelson	... James II.
A Reputed Changeling...	Charlotte M. Yonge.	Macmillan	... James II.
The Chaplain of the Besant Fleet.	... Chatto and Windus...	...	George II.

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SPECIMEN CALENDAR OF INDIAN HISTORY

March 1,	1776.	Treaty of Purandhar.
" 2,	1869.	Death of Field Marshal, Lord Gough.
" 3, A.D.	78.	Beginning of the Saka era.
" 4,	1325.	Death of the Muhammadan Saint, Nizam-ud-din Aulia at Delhi.
" "	1811.	Birth of John, Lord, Lawrence.
" 5,	1799.	Battle of Seedasir.
" "	1809.	Shah Shuja, the Amir, receives the English envoy, M. Elphinstone, at Peshawar.
" 6,	1697.	Birth of General Stringer Lawrence, Clive's chief.
" 7,		
" 8, A.D.	319.	Commencement of the Gupta era.
" 9,	1818.	Protectorate over Bikanir.
" "	1846.	Treaty with Lahore.
" 10,	1828.	English Annexation of the Jalandhar Doab.
" 11,	1399.	Lord Amherst leaves India.
" "	1784.	Timur crosses the Indus and leaves India.
" "	1795.	Treaty of Mangalore with Tipu.
" "	1795.	Battle of Kurdla: The Nizam defeated by the Marathas.
" "	1863.	Death of Sir James Outram, 'The Bayard of India.'
" 12,	1798.	End of Sir John Shore's administration.
" "	1842.	Lord Auckland leaves India.
" 13,	1800.	Death of Nana Farnavis at Poona.
" 14,	1206.	Muhammad Ghori assassinated.
" "	1858.	Capture of Lucknow.
" 15,	1846.	Gulab Singh made Maharaja of Kashmir.
" 16,	1527.	Battle of Kanwasha or Fatehpur-Sikri.
" 17,		
" 18,		
" 19, A.D.	499.	Epoch of Aryabhata and other Indian Astronomers.
" " A.D.	505.	Epoch of Varahamihira's Panchasiddhantika.
" " A.D.	1113.	Probable date of the commencement of the Sivasimha era of Gujarat.
" 20,	1351.	Death of Muhammad Bin Taghlak at Thatta in Sindh.
" "	1827.	Death of Daulat Rau, Sindia.

March 20,	1836.	Auckland, Governor-General, Accession.
" 21,	1849.	Annexation of the Punjab.
" 22,	1482.	Death of Muhammad Shah II, the last independent king of the Bahmini dynasty of the Dakhan.
" 23,		
" 24,	1307.	Malik Kafur carries Ramadeva of Devagiri prisoner to Delhi.
" "	1854.	First telegraph message flashed between Agra and Calcutta.
" 25,	1798.	Death of General Raymond, French leader in the Service of the Nizam.
" 26,	1206.	Kutb-ud-din Aibak crowned at Lahore.
" 27,	1799.	Battle of Malavalli—Tippu Sultan defeated by General (later Lord) Harris.
" 28,		
" 29,	1812.	Death of Purnia, the administrator of Mysore.
" 30,	1785.	Lord Hardinge born.
" 31,		

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Descriptive statement of the data supplied for graphs

Graph. I.—Aim—to show the connexion between English policy towards Scotland and France.

Data—1 (a) Chronological list of the wars between England and France 1066—1558.

(b) Chronological statement of the relations between England and Scotland.

Graph. II.—Aim—Interconnexion between domestic and foreign policy in England (1689—1748) to be shown.

Data—2 (a) List of English ministries during the period.

(b) List of French ministries during the period.

(c) Chronological statement showing the chief Jacobite plots and risings during the period.

(d) List of constitutional events during the period.

(e) List of continental wars during the period.

Graph. III.—Aim—To show the interconnexion between the Indian wars of England, in the period 1689—1815, and its continental and colonial wars during the same period.

Data—3 (a) Continental and colonial wars of England.

(b) Indian wars of the period.

Graph. IV.—Aim—To show the connexion between the forward movement of the rival powers—England and Russia—in Asia in the 19th century.

Data—4 (a) Russian advance in Asia during the century.

(b) forward movement of the English in India during the period.

(c) List of Indian governors-general.

(d) List of English ministries 1800—1900 (the distinction of party noted.)

(e) List of Russian foreign ministers during the century.

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Lectures on the Principles and Methods of Teaching History

PRACTICAL WORK

1. Maps:—

- Draw on transparent paper a map to illustrate the rise and wane of English dominion in France.
- Illustrate by a diagrammatic map the marches of the chief armed forces during the English Civil War.
- Draw on transparent paper coloured maps exhibiting the chief political divisions of India about 1526, 1605, 1761 and 1805.

2. Plans:—

Draw a plan of any battle (in English or Indian History), and prepare 'notes' of a lesson thereon for the VI Form.

3. Graphs:—

Make graphs from the data supplied.

4. Examinations:—

- A paper for the II Form—Indian History 1600—1857—time 100 minutes—answers to be in the Vernacular.
- A paper for the III Form—Indian History—(the whole in outline)—answers to be in the Vernacular, but names to be written out in English—time two hours.
- A paper for the IV Form—English History—time two hours—either (a) on the whole subject, or (b) up to the end of the Tudor period.
- (a) A paper for the V Form—Indian History—the whole—two hours and a half.
(b) A paper on English History—the Stuarts and the Hanoverians—two hours and a half.

N.B.—Indicate the division of marks in each paper.

5. Lesson 'Notes':—

Prepare 'Notes' of lessons on the following topics:—

- A story for IV Standard.
- A lesson on Akbar for I Form, or on Warren Hastings for II Form.
- A lesson on Bentinck for III Form.
- Lessons on Henry II or Edward I for IV Form.
- Lord Wellesley's administration—for the V Form.
Elizabeth—for the V Form.
- VI Form:—(1) Tudor Government compared with that of the Stuarts.
(2) Causes of the rise and fall of either French or Portuguese dominion in India.

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Syllabus of Indian History

ELEMENTARY SCHOOL

FORM III

- The principal natural divisions of India, and its present inhabitants.—The chief non-Aryan races.
- The Indo-Europeans (Aryans).—Their immigrations and settlements.—Aryan life.
- Aryan expansion.—Caste.—Religious and political conditions down to 500 B.C.
- Jainism and Buddhism.—The Kingdom of Magadha.
- Darius.—Alexander.
- The Mauryan Empire.—Chandragupta.—Asoka.
- The successors of the Mauryas.—Religious rivalries.—The Vernaculars and Sanskrit.
- Foreign invasions and Settlements.—The Bactrians and the Scythians.—Menander.—Kanishka.
- The Imperial Guptas.—Brahmanic revival.
- Harsha.—The Chalukyas of the Dakhan.—The Pallavas.—Yuwan Chwang (Hiouen Thsang).
- The Rajputs.—The later Chalukyas.—The great Cholas.—Conflict with the Muhammadans and the disappearance of the old dynasties.
- Muhammad.—The chief Mahammadan invasions of India down to A.D. 1000.
- Sultan Mahmud.—Muhammad Ghori.
- The Slave Kings.—Their successors (to C. 1300 A.D.)
- Ala-ud-din.—Muhammad-ibn-Tughlak.—Firuz Shah.—Timur.
- The Kingdoms of Gulbarga and Vijayanagar.
- The Great Mughals (1526-1707).
- The Marathas.—Shivaji; Sahu; the Peshwas.—The Maratha league, its rise, wars and dissolution.
- The Europeans in India.—The Portuguese power. Its progress and decline.
- The Dutch, English and French.—'East India' Companies.—Their rivalries.
- Wars in the Karnatik and Bengal (to C. 1765 A.D.).—Dupleix.—Clive.
- Warren Hastings.—Mysore and Maratha wars.
- Cornwallis, Shore and Wellesley.—Mysore and Maratha wars (continued).
- Minto, Moira (Hastings) and Amherst.—Maratha wars (concluded).—Nepal.—Burma.
- Bentinck.—Auckland and Ellenborough.—Afghan war.
- Hardinge and Dalhousie.—The Sikhs and Sikh wars.—Annexations.
- Canning.—The Mutiny.—The Proclamation.
- India under the Crown (down to 1901).

University of Madras.

Select Dates in Indian History

(AUXILIARY TO THE SYLLABUS FOR FORM III OF THE
ELEMENTARY SCHOOL)

1. 500 B.C. *Circa.* The Buddha.
2. 323 " " Death of Alexander.
3. 272 " " Acc. of Asoka.
4. 155 " " Pushyamitra.—Menander.—Kharavela.
5. 125 A.D. " " Acc. of Kanishka.
6. 350 " " Samudragupta.
7. 630 " " Harsha.—Pulakesin II.
8. 1000 " " Raja Raja Chola.—Mahmud of Ghazni.
9. 1100 " " Kulottunga Chola.—Vikramanka Chalukya.
10. 1193 " " Second battle near Thanesar.
11. 1206 " " Kutb-ud-din acc.
12. 1316 " " Ala-ud-din's death.
13. 1351 " " Death of Muhammad ibn Tughlak.
14. 1480 " " The disruption of the Kingdom of Gulbarga.
15. 1498 " " Vasco da Gama.
16. 1530 " *Circa.* Death of Babar, Rana Sangramasimha ('Sanga') and Krishna Deva Raya.
17. 1556 " " Akbar acc.
18. 1600 " *Circa.* Founding of the Dutch and English East India Companies.
19. 1605 " " Death of Akbar.
20. 1623 " " Massacre of Amboyna.
21. 1658 " " Aurangzeb acc.
22. 1680 " " Death of Sivaji.
23. 1707 " " Death of Aurangzeb.
24. 1714 " " Balaji Visvanath, Peshwa.
25. 1720 " *Circa.* Rise of the Haidarabad State.
26. 1739 " " Sack of Delhi by Nadir Shah.
27. 1748 " " Death of Muhammad Shah, Sahu and Asaf Jah (Nizam-ul-Mulk).
28. 1757 " " Plassey.
29. 1761 " *Circa.* Panipat.—Surrender of Pondicherry.
30. 1765 " " Diwani over Bengal, etc., acquired.
31. 1772 " " W. Hastings.
32. 1782 " *Circa.* Salbai.—Death of Haidar Ali.
33. 1799 " " Death of Tipu Sultan.
34. 1803 " " Assaye.
35. 1818 " " Overthrow of the Peshwa.
36. 1833 " " E. I. Co. ceases to trade.
37. 1839 " *Circa.* Ranjit Singh's death.—Afghan War.
38. 1846 " " The first Sikh War.
39. 1849 " " Annexation of the Punjab by Dalhousie.
40. 1852 " " Annexation of Pegu.
41. 1857 " " The Mutiny.
42. 1858 " " The Queen's Proclamation.
43. 1877 " " The Queen Proclaimed Empress of India.
44. 1886 " " Annexation of Upper Burma.
45. 1897 " " The Queen Empress' Diamond Jubilee.
46. 1901 " " Death of the Queen Empress.—Edward VII acc.

University of Madras.

Vacation Lectures, 1908-09

Exercises in Practical Physics for teachers working in the Elementary Physical Laboratory, Presidency College

1. Measurement of Lengths—
 - (a) Prepare a cm. scale reading in $\frac{1}{2}$ cm. up to 25 cm. and measure with it the lengths of the sides of the given set square to a mm. by 'estimation' and verify them with the given mm. scale.
 - (b) Examine and describe the given rule. Plot a curve shewing the relation between inches and centimetres. Deduce from your measurements the length of a cm. in terms of an inch and vice versa.
 - (c) Measure the circumference of circles with (i) a thread and scale, and (ii) spring dividers and scale, and deduce the value of π .
 - (d) Measure the diameter of a ball, and cylinder.
2. Measurements of areas—
 - (a) Find the area of a polygon by the method of triangulation.
 - (b) Find the area of any figure with squared paper.
 - (c) Find the area of any figure by 'weighing' method.
3.
 - (a) Find the weight of the given cylinder by (i) the ordinary method, and (ii) the method of substitution, with a balance and set of weights, and calculate its density.
 - (b) Find the weight of a c.c. of distilled water with the sp. gr. bottle.
4. Measurement of volume—
 - (a) Find the volume of the given solid by the method of displacement.
 - (b) Find the volume of the given solid by the Archimedes' principle.
 - (c) Find the volume of a pycnometer or a pipette correct to $\frac{1}{100}$ th c.c.
5. Prepare a test tube float and use it to determine the sp. gr. of the given liquids by the method of (i) variable immersion, and (ii) of constant immersion.
6. Find the sp. gr. of the given liquid with the pycnometer or narrow-necked flask.
7. Find the sp. gr. of the given (i) solid, and (ii) liquid, with an india-rubber chord and a set of weights.
8. Compare the densities of the given liquids with the U tube.
9. Find the pressures inside a liquid at different depths and draw the depth pressure curve.
10. Find the weight of a litre flask full of air and its weight when as much air as possible is removed from it by sucking and shew that air has weight; repeat the experiment by compressing air in the flask by blowing in or with a bicycle pump.

11. (a) Set up a Boyle's law apparatus; draw the V-P. curve for dry air for pressures above and below one atmosphere.
(b) Prepare a thistle tube (3 mm. diameter and) 100 cm. long, closed at one end and having a thread of mercury about 35 cm. long in the middle of it and evaluate the atmospheric pressure.
12. (a) Heat water in a small beaker over a steady flame; note when 'singing' occurs; and draw the time-temperature curve.
(b) Heat an equal weight of turpentine under the same conditions as in (a) and draw the time temperature curve up to 105°C. Write your inferences from the above 2 curves.
13. Arrange the following substances in the ascending order of their heat capacities, as deduced from simple experiments:—water, turpentine, copper, iron and mercury.
14. Draw a curve of cooling for melted paraffin in a test tube and find the melting point of that substance; repeat the experiment by reversing the process.
15. Test the boiling and the freezing points of the given Centigrade and Fahrenheit thermometers. Draw a graph shewing the corresponding readings on the two scales for different temperatures, between the 2 fixed points.
16. Determine approximately the latent heat of vaporization of steam and the latent heat of fusion of ice.
17. Determine the amount of aqueous vapour present in the atmosphere by a chemical method.
18. Verify, by the pin method, the laws of reflection at a plane mirror and the laws of distances of the object and image. Describe the nature, size and appearance of the image of a printed page.
19. Trace the paths of rays, incident at different angles, and refracted from glass to air and deduce the laws of refraction. Note the direction of bending or 'deviation' when refracted from glass to air and vice versa. Plot the i-r curve in the former case and write your inference.
20. Trace the paths of rays refracted through a plate of glass and note the deviations for these rays.
21. Trace the path of a ray through a glass prism and note the direction of bending or 'deviation' of the emergent ray.
22. Verify the law of distances for reflection at a concave mirror; draw the u-v curve; describe the nature and size of the image in its various positions.
23. (a) Verify the law of distances for refraction through a convex lens; describe the nature and size of the image in its different positions. Draw the u-v curve and write your inferences from the curve.
(b) Determine the focal distance of the convex lens by focussing a distant object on a screen.
24. Construct a model telescope. Describe the nature and size of the image seen through it. How would you shew the purpose of the two lenses separately? Sketch neatly the path of a parallel beam of light through the instrument.
25. Arrange a convex lens as a simple microscope; describe the nature and size of the image and find its position.

26. (a) Arrange a slit, a prism and a screen to produce a solar spectrum, the prism being placed in different postures. Draw a neat sketch of the arrangement and result in each case. State the order and arrangement of colours in the spectra formed. Describe the spectra observed when differently coloured plates are interposed between the slit and prism, screen and prism, etc.
(b) View an illuminated slit through a prism and state the order and position of the coloured images seen.
27. Construct a simple galvanoscope, given a compass box and a coil of wires.
28. (a) Set up a voltaic cell and draw a curve shewing the variation with time of the deflection due to a current drawn from the cell and demonstrate the cause of the variation.
(b) Set up a Grove's cell and repeat the above experiment.
29. Draw a curve shewing the variation with time in the volume of Hydrogen or Oxygen evolved in the electrolytic decomposition of water and mention how you would identify the poles of any battery by this method.
30. Draw the space-time curve with a dropping smoked plate and shew that gravity produces an acceleration in the falling body.
31. Draw the 'slope'-power curve with an inclined plane. Shew that power ÷ 'slope' is a constant and equal to the weight.
32. Arrange the given pulleys into a system with one fixed and one moveable pulley and determine the mechanical advantage of the system.
33. Investigate the relation between the period of a simple pendulum and (i) bobs of different weights, (ii) bobs of different materials, (iii) swings of different arcs, and (iv) different lengths, severally, and shew the relation by a curve in the last two cases.
34. Prepare a spring balance and calibrate it to read to 100 grammes in 10 steps; plot the weight-extension curve.
35. Shew that bending is proportional to the weight applied and find the relation between the bending of a lath and its length.

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VACATION LECTURES, 1908-09

Programme of Work for Teachers working in the Elementary, Physical,
Laboratory, Presidency College, Madras

On 14th January, 1909

I. CONVERSAZIONE

TIME—8 TO 10-30 A.M.

Teachers will go through this Course in three batches of ten each and attend to the following three departments giving fifty minutes to each. They are requested to note down their doubts and difficulties and the points about which they desire to have information beforehand, ready for immediate reference when the work begins. They should have special reference to the work to be done by them and their boys in Physics.

(a) Tools and Instruments

Teachers are recommended to learn to identify, the simple carpenter's, tinman's and metalsmith's tools some of which are recommended in the 'Hints and Suggestions to Managers of Secondary Schools.' Practical demonstrations of their uses will be given by the College Mechanic wherever necessary. The most suitable dimensions for the tools required for common use in elementary physical laboratories can be ascertained from the mechanic.

(b) Exercises prescribed for the Lecture Course

The apparatus prepared for all the above exercises will be kept arranged on the working tables for inspection and study. Information regarding the construction and fitting up of the pieces of apparatus not handled by the teachers during the course, and any details regarding the local make of the several pieces will be supplied by the demonstrator in charge.

(c) General

Simple devices for illustration and demonstration, adaptation of the physical apparatus noted in the 'Hints and Suggestions' to the demonstrations mentioned in the list, care of apparatus, the local make and fitting up, the cost and availability of any piece of apparatus, and any matter of general importance connected with the teaching of physics in High Schools can be ascertained in this course.

The difficulties met with by teachers in their Laboratory work, will, on reference, be explained.

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University of Madras.

SYLLABUS OF PRACTICAL WORK IN CHEMISTRY

For the University Vacation Course
at the Presidency College, Madras—Christmas, 1908

1. To cut sheet glass with a broken file or diamond. To trim the edges of sheet glass with glass pliers dipped in camphorated turpentine.
2. To cut soft glass tube or rod with a file (or chrome steel plate). To lead a crack round a tube or breaker by means of a hot glass bead or wire (or glowing charcoal pastille).
3. To cut combustion or Jena tubing or bottles.
4. To drill holes in sheet glass, tubing or stoppers by means of a China drill, small Archimedean drill or ground file moistened by a 10 per cent solution of camphor in freshly distilled turpentine.
5. To grind the ends of glass tubes and to grind in stoppers with flour emery and camphorated turpentine. (Test of Perfect Fit?).
6. To bend glass tubing in batwing oil-gas flame or Etna blast flame, securing planeness of bends by laying on sheet asbestos. To round the ends of glass tubes before they are passed through holes bored in corks.
7. To sharpen cork borers with a round file inside and with a triangular file outside. To soften corks. To bore 3 parallel holes in a cork of 15 mm. diameter starting from the narrow end and finishing up on a cork pad. To trim the holes with a round file. [N.B.—Note the convenience of using a borer of 5 mm. diameter and tubing, thermometers, etc., of 6 mm. diameter. Corks may be protected against the action of halogens, SO_2 , etc., by soaking them for some minutes in melted paraffin wax or by affixing thin asbestos paper by means of 'water glass.' In no case should paraffin wax, sealing wax or marine glue be applied to correct a loosely fitting tube or a porous cork: a new and sound cork must be bored afresh].
8. To bore holes in rubber stoppers (chosen to fit necks very loosely) with borers dipped in methylated spirit (or potash or glycerine).
9. Miscellaneous. To clean dirty glass tubing. To dry out a wet flask.
10. To draw capillary tubes and to close the ends of a narrow glass tube to form a stirring rod.
11. To seal the ends of wide tubing and to 'border' tubing, as illustrated by the repair of test tubes broken at either end.
12. To make bulbed ignition tubes.
13. To draw a side tube out from a test-tube.
14. To weld platinum foil 2 cm. by 1 cm. into the form of a tube and to seal it as a jet in the end of a glass tube.
15. To separate the constituents of a mixture of sand, potassium chloride and ammonium chloride.

16. To determine the solubility of nitre in water at 30°, 60° and 90° and to plot a curve.
17. To separate nitre and common salt by fractional crystallization.
18. To show the increase of weight when a candle, sulphur and magnesium burn in air.
19. To calibrate a bell jar and to prepare nitrogen by burning phosphorus in air.
20. To prepare oxygen from potassium chlorate and to examine its properties.
21. To prepare hydrogen by the action of sodium on water.
22. To prepare hydrogen by the action of dilute acids on zinc and to illustrate its properties. To prepare zinc sulphate.
23. To synthesize water by burning hydrogen in air.
24. To synthesize water by passing hydrogen over heated copper oxide, and so determine the gravimetric composition of water.
25. To decompose water by passing steam over red-hot iron.
26. To prepare carbon dioxide and to exhibit its properties.
27. To prepare nitric acid.
28. To prepare ammonia and to examine its behaviour.
29. To prepare chlorine and to examine its power of combining with metals and with hydrogen.
30. To prepare hydrochloric acid.
31. To prepare salts by the interaction of nitric acid and caustic soda, sulphuric acid and copper oxide, hydrochloric acid and magnesia, nitric acid and ammonia.

ADDITIONAL EXERCISES

- A. To estimate the oxygen of air and of 'air' dissolved in water by alkaline pyrogallol.
- B. To fit up entirely from materials an apparatus for the electrolysis of water.

University of Madras.

VACATION LECTURES ON CHEMISTRY, 1908-09

Delivered at St. Joseph's College, Trichinopoly

NOTE.—Experiments marked with an asterisk[*] might all be made by the students under the supervision of the teacher.—The Roman numbers IV and V in each group of experiments indicate the portions that might conveniently be allotted to the Fourth and Fifth Forms respectively. No special portion is assigned to the Sixth Form where a revision of the two previous portions is supposed to take place.

I

Requisites—

Large test-tubes (boiling tubes), India-rubber corks with one and two holes, flask, thistle funnels, two-necked Wolf's bottle, three ordinary wide-mouthed bottles, corks, cork-borer, glass-tubing, narrow and wide, alcohol lamp or Bunsen burner, two gas jars (large test-tubes may do), a round piece of charcoal pointed at one end, ignition tubes, two platinum wires, file.

N.B.—For references and explanations apply to Demonstrators. For working of glass, use may be made of foot-bellows; full directions for glass work will be found in Section III of 'Laboratory Arts,' by G. H. Woollatt.

Agenda—

- * 1. Fit up three or four typical forms of gas-generators for light and heavy gases. (Newth, Elementary Practical Chemistry, p. 28.) IV
- * 2. Make a wash-bottle and test whether the flask is air-tight. (Perkin, p. 68.) IV
- * 3. Draw out a piece of glass tubing to a fine jet for subsequent use (for instance, in *Harmonica Chimica*). V
4. Open out the end of a wide glass tube so that a cork may easily be fitted into it. V
5. Cut off the upper half of a wide-mouthed bottle; seal platinum wires into two ignition tubes and fit up a simple voltameter for subsequent use. (For detailed directions see Perkin and Lean, p. 225 or Newth, p. 76.) V
- * 6. Round the ends of your jet tubes and delivery tubes with the mouth blowpipe. IV
7. Make a small glass funnel (mercury funnel) by drawing out an ordinary test-tube. V

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II

Requisites—

Iron wire (both thin and stout), vice, pliers, horse-hair, corks, cork-borer, taper or wax-candle, stoppered delivery tube, glass tubing, India-rubber tubing (small piece), gas jar, lamp chimney, small piece of perforated ebonite or coarse pebbles, small gas generator (to be fitted up), granulated zinc, strong hydrochloric acid, graduated jar, trough (glass or earthenware), balance.

Agenda—

- * 1. Make a test-tube brush. (Apply to laboratory boy.) V
- * 2. Make a deflagrating spoon. (For directions see Macnair, p. 40.) V
- * 3. Fasten a taper or small piece of wax-candle to a piece of iron wire; insert this into a cork ready for use in the bell-jar experiment, or for illustrating combustion in oxygen. IV
- * 4. Make a clip, an iron wire triangle, and a capsule holder, imitating the models at your disposal. V
- 5. With the gas jar, the lamp chimney and corks, the stoppered delivery tube, make a gas generator to obtain a continuous supply of hydrogen. (Macnair, p. 68.) V
- 6. Fit up a small gas generator for hydrogen. Weigh out from 1 to grammes of granulated zinc. Ascertain roughly the number of c.c. of hydrogen obtainable from it (Newth, p. 136). V

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III

Requisites—

Iron filings, flowers of sulphur, powdered charcoal, nitre, sand, CS_2 solution, magnet, gunpowder, test-tubes in stand, alcohol lamp or Bunsen burner, funnel, filter paper, mortar, dilute HCl , simple gas apparatus, plaster of Paris, distilled water, glass rod, beaker, evaporating vessel or watch glass, tripod or retort stand with gauze, sand-bath, copper sulphate, a piece of squared (or section) paper.

Agenda—

- * 1. Suggest and actually make experiments of your own to illustrate the difference between compounds and mixtures. (If necessary, apply to Demonstrator for chemicals). IV
- * 2. Separate the ingredients of gunpowder. IV
- 3. Ascertain whether and to what extent plaster of Paris is soluble in water, with a view to illustrating the term '*solution*.' (Perkin, p. 105.) V
- * 4. Illustrate (practically) the terms '*filtration*,' '*decantation*.' What physical property is made use of in the process of filtration? IV
- 5. Evaporate a portion of the clear filtrate on a sand-bath. (Perkin, p. 107.) V
- 6. Evaporate some tap water on a water-bath, and explain the term '*evaporation*' and the reason why a residue is left. V
- 7. Show that CS_2 is *volatile*. Explain to the class the meaning of volatility and devise an experiment to illustrate the chief effect of volatility. V
- * 8. Make a cold *saturated* solution (explain the term) of copper sulphate, and then show the influence of temperature on solubility. V
- * 9. Plot the solubility curve of nitre, the following results of experiments being given. (Perkin, p. 112-113):— V

100 grammes of water dissolve				20 grammes of nitre at 10°C .			
100	"	"	"	32	"	"	20 "
100	"	"	"	45	"	"	30 "
100	"	"	"	63	"	"	40 "
100	"	"	"	86	"	"	50 "

- 10. With the help of the foregoing experiments explain the terms (a) '*conduction of heat*' (boiling a solution in a test-tube without test-tube holder, or folding a piece of paper round the upper part of the tube); (b) '*insolubility*' (of FeS in CS_2 , sand in ordinary water); (c) '*chemical combination*' (Fe and S); (d) '*decomposition*' (HCl by Fe , or FeS by HCl); (e) '*substitution*' (Fe by H_2); (f) '*combustibility*' (of H , H_2S , CS_2 with consequent change of properties both physical and chemical).

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IV

Requisites—

A large glass funnel, a taper or piece of candle, small glass cup or watch glass, lime-water, iron wire, taper holder (made on a previous occasion), gas jar, piece of thin sheet metal or cardboard (T shaped), deep glass vessel filled with water, simple aspirator, gas-washing bottle, U-tube with side openings, platinum wire or asbestos fibre, lamp chimney fitted up for suspension, caustic potash.

Agenda—

* 1. Devise an experiment to illustrate practically the facts that (i) water and carbonic acid gas are formed when a candle burns; (ii) the air in which a candle is burning loses its power of supporting combustion; (iii) carbon or soot is formed in an insufficient supply of air; (iv) the smoke evolved after extinction of the flame contains unburnt particles of gas.

IV

* 2. Introduce the burning taper into the gas jar at your disposal and arrange for a constant supply of air. Explain in this connexion the formation of winds. Is there any connexion between this and the use of lamp chimneys? (See use of glass chimney, St. Jos. Coll. Elem. Chem., 4th Ed., p. 54.)

V

* 3. Sink the gas jar with burning taper in a deep glass vessel (a bucket might do) and ascertain the deposition of water drops on the inner sides of the vessel.

V

4. Set up the apparatus indicated in figure 10, St. Jos. Coll. Elem. Chem. and actually perform the experiment. If the experiment is to last any considerable time, it is advisable to replace the glass funnel by a lamp chimney. Why?

V

5. Replace the gas-washing bottle by an empty U-shaped tube plunging in water. What will be the result?

V

* 6. Point out, by means of a platinum loop or a fibre of asbestos, the different zones of a burning candle. (St. Jos. Coll. Elem. Chem., p. 57). Explain why you use platinum (p. 189) or asbestos (p. 53) and show that there is a difference of temperature in the various zones.

IV

7. Show, by means of the gas burner at your disposal, the way to obtain a luminous and a non-luminous flame. (pp. 58-59.)

V

8. Show by actual experiment that the constituents of the candle combine with the oxygen of the air and that the combustion products are heavier than the candle (St. Jos. Coll. Elem. Chem., p. 34. Cf. also Perkin, pp. 195-196.)

V

V

Requisites—

Test-tubes in stand, red and yellow mercuric oxide, rib of dry cocoanut leaf, alcohol lamp or Bunsen burner, potassium chlorate, lead nitrate, gas eprouvettes (large test tubes may be used), litmus paper, student's gas apparatus, condensing flask or jar, wax, paraffin, ammonium chloride, small porcelain crucible with lid, tripod with iron wire triangle, solid potash, manganese dioxide, balance.

Agenda—

* 1. Prove by actual experiment that the red or yellow compound of mercury is split up into two elements, viz., oxygen gas and minute globules of mercury. Explain the difference between compounds and elements, combination and decomposition. Explain also why this method of obtaining oxygen gas is only of theoretical or classical interest, but of no practical or economical value.

IV

* 2. Show that potassium chlorate is also decomposed into oxygen gas and a white substance or residue.

IV

* 3. Show that lead nitrate, besides oxygen gas, also yields brown vapours of nitrogen peroxide, and that in this case a yellow residue is left.

IV

What further differences are observed in these three cases of *decomposition*? Elicit answers from students supposed to be making these experiments in class.

* 4. Devise experiments to illustrate the terms *liquefaction*, *sublimation*. Heat a piece of wax or of paraffin in a capsule and allow it to cool. Compare this with heating mercuric oxide, potassium chlorate, lead nitrate. Illustrate the difference between *chemical* and *physical changes*. (Instead of this you might make experiment 28, Newth Elementary Practical Chemistry.)

V

* 5. Gently heat some alcohol in the simple gas generator at your disposal and condense the vapour. Is it a physical or a chemical change? (Cf. Newth, pp. 2-3. V

* 6. Heat separately a small pinch of powdered nitre and a pinch of lead nitrate in a cavity on charcoal with the help of a blowpipe. Explain the reason of the resulting phenomenon. Can this result be made into a general statement? What is the meaning of *deflagration*?

V

7. Determine as accurately as you can the amount of oxygen contained in one gramme of potassium chlorate (Macnair, p. 33).—This may be done with an ordinary test-tube, weighing it before and after.

V

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VI

Requisites—

Iron filings, wide-mouthed bottle, glass basin, reduced iron (prepared, when required, by heating oxide of iron in a reduction tube and passing a stream of hydrogen or coal gas through the tube), reduction tube, alcohol lamp or Bunsen burner, balance, bell-jar with basin, capsule, broad flat cork, yellow phosphorus, flowers of sulphur, sodium, deflagrating spoon, cork fitting air-tight, eudiometer or barometer tube and basin, dry round-bottomed flask (8 oz.) fitted with a good India-rubber cork with one hole, glass tube with rubber tube and clip, or a glass stop-cock.

Agenda—

* 1. Show that iron rusts in moist air; that, during rusting, some of the air disappears; that rusting is therefore oxidation. (Perkin, p. 175.) IV

* 2. Show with the help of the reduced iron at your disposal or which you may have prepared, that finely divided iron may be easily made to burn; that it burns or smoulders without a flame; that burning is similar to rusting (i. e., oxidising); that, while burning, iron increases in weight. IV

* 3. Perform the bell jar experiment proving that air contains O and N in the proportion 1 : 4. IV

4. Show that the same phenomenon takes place, but slowly, when a piece of phosphorus is smouldering in a limited volume of air. V

Elicit answers to the following questions in connexion with the bell-jar experiment. At first the level of the water falls in the bell-jar; why? Why is it necessary to allow the apparatus to get quite cold before ascertaining how much air has disappeared.

* 5. Illustrate the differences you would observe, if instead of P, you took S, iron filings, or a bit of sodium, a candle or a taper. V

6. With the round-bottomed flask at your disposal, the glass stop-cock, or glass tube with rubber tube and clip, perform an experiment to prove that in the case of P as in that of iron rust, the new compound P_2O_5 weighs more than the original solid from which it was formed. (Macnair, pp. 29-30.) V

7. Suggest reasons to prove that the bell-jar experiment is not reliable for demonstrating the relative volumes of O and N, and devise one that is more reliable. V

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VII

Requisites—

Test-tubes in stand, crystalline potassium chlorate, manganese dioxide, test-tube holder, retort stand with clamp, two lamps, gas collecting bottles and rib of cocoanut leaf, piece of candle or taper with holder, simple oxygen generator, clean iron wire, sand paper, wax thread or tinder, S., C., iron filings, deflagrating spoon to be made with iron wire and bone-ash crucible, pipette, lime-water, litmus solution, flask (flat-bottomed) provided with a delivery tube and a stoppered funnel, sodium peroxide.

Agenda—

* 1. Compare the time taken by KClO_3 alone, and by a mixture of KClO_3 and MnO_2 to give up O when subjected to the same source of heat. (Cf. St. Jos. Coll. Elem. Chem., p. 63.)

IV

2. Prepare six bottles of O and burn in one of them a piece of candle; in another, charcoal; in the third, sulphur; in the fourth, an iron wire (perfectly clean, why? St. Jos. Coll. Elem. Chem., p. 64); in the fifth, a bit of sodium; in the sixth, iron filings. (See Macnair, Exp. 27-28.)

IV

3. Make the required deflagrating spoons with the bone-ash cupels at your disposal.

Elicit answers to the following questions:—

IV

(i) What difference is there between burning in air and burning in oxygen? Explain why the freshly cut surface of sodium gets tarnished so soon.

(ii) Why is there a flame in the case of sulphur and none in the case of iron? What oxide of iron is formed? Is it the same as rust? Test with a magnet.

(iii) What precaution is to be taken to prevent the molten iron from breaking the glass?

(iv) What physical differences are observed between the oxides obtained?

4. Test the nature of these oxides. Add the solution obtained in the case of S to that obtained in the case of Na. What happens, and why?

IV

5. Prepare some oxygen from sodium peroxide (Newth, Exp. 61) by means of the flask fitted with a delivery tube and stoppered funnel. Show that the liquid in the flask has properties exactly the same as the solution obtained by the action of Na upon water. Owing to its properties sodium peroxide is very useful; suggest some of its important uses.

* 6. Suggest and actually make an experiment to prove that respiration is somewhat similar to the burning of a candle, and is consequently a process of oxidation. (St. Jos. Coll. Elem. Chem., pp. 54 and 55.)

V

69
40

7

VIII

Requisites—

Small Kipp's apparatus, gas collecting bottles and trough, dilute HCl, iron turnings, granulated zinc, taper, concentrated sulphuric acid, gas-washing bottle, glass tubing, India-rubber corks and tubing, potash solution, two evaporating beakers or large test-tubes, assorted tubes for Harmonica Chimica, sodium, mercury, voltameter or requisites for making it, stout eudiometer, piece of lead pipe, flask for boiling water, lamp or burner, hard glass-tube (large test-tube) or iron gas pipe packed with clean iron, stands and clamps, two bichromate cells, Ruhmkorff coil.

Agenda—

- * 1. Fit up a gas-washing bottle imitating the model at your disposal. V
- * 2. Prepare H free of water and of acid vapour, illustrating the use of potash and of sulphuric acid as purifiers and neutralisers. V
- * 3. Show that H gas is light, combustible, explosive when mixed with O or air (supports the combustion of O). IV
4. Show what you mean by '*Harmonica Chimica*.' (St. Jos. Coll. Elem. Chem., No. 50). IV
- * 5. Illustrate and compare the method by which *white vitriol* and *green vitriol* are obtained from *oil of vitriol*. Show also the difference in the result when, instead of Fe and Zn, their oxides are used. IV
6. Prepare sodium amalgam, or introduce a piece of sodium into a small piece of lead pipe (Newth, p. 42) and by its means obtain H from water. V
7. With the voltameter at your disposal decompose H_2O testing the resulting gases for O and H. V
8. Collect both gases as they are evolved in one stout eudiometer and explode by means of spark. Account for the phenomenon observed both immediately after the explosion and after cooling. (St. Jos. Coll. Elem. Chem., No. 54.) V
9. Prepare some H by heating iron turnings in steam. (Macnair, p. 56; St. Jos. Coll. Elem. Chem., No. 49.) V

70 41

IX

Requisites—

Piece of coal, graphite, CO_2 apparatus, marble, magnesium carbonate, dilute HCl , 2 gas jars lime-water, litmus paper or solution, alcohol lamp, magnesium ribbon, china-dish, glass rod or tube, test-tubes, retort stand, paraffin or kerosine oil, turpentine, sugar, rice grains, chips of wood (matches), concentrated H_2SO_4 , clay tobacco pipe, 2 gas-washing bottles, aspirator, large beaker, stoppered funnel or ordinary funnel, bell-jar with cork to fit and wire carrying a candle, trough for bell-jar, water-cress or pond-weed.

Agenda—

- * 1. Prove by actual experiment the presence of C in wood, paraffin or kerosine oil, sugar, rice, CO_2 . (St. Jos. Coll. Elem. Chem., Nos. 97, 98, 16.) IV
2. Illustrate the process known as '*destructive distillation*,' the preparation of wood charcoal, soot and coal gas. (No. 99.) IV
3. Show that the alcohol or gas which you use forms CO_2 on burning, and that CO_2 can be obtained from carbonates without the use of acids. IV
- * 4. Collect a cylinder full of CO_2 and ascertain by actual experiment whether the cylinder is filled with the gas. (St. Jos. Col. Elem. Chem., No. 69; Gregory and Simmons, p. 354.) IV
5. Prove that green leaves give off O in sunlight. How to account for the fact? Suggest an experiment to prove the point. IV
6. Find the effect of a plant on air which contains CO_2 in place of O. (Wilson and Hedley, p. 75). Prove that there is CO_2 in the air exhaled from the lungs. (Gregory and Simmons, p. 355; St. Jos. Coll. Elem. Chem., No. 36.) IV

71
42

X

Requisites—

Test-tubes, powdered charcoal, H_2S solution, strong ammonia, logwood, desiccating turret filled with lumps of charcoal, double bent delivery tube, funnel, filter-paper, 2 oz. flask, litmus paper and solution, CO_2 apparatus, glass tube, 2 beakers, lime-water, distilled water, soap, magnesium carbonate, sodium carbonate, retort and condenser, lamp, sea-water, well-water, balance.

Agenda—

1. Prove the great absorbent power of charcoal for gases, its use as a deodoriser, disinfectant, decolouriser, water-filter. (St. Jos. Coll. Elem. Chem., No. 98.) **V**
- * 2. Disprove the statement: CO_2 is a weak acid. (No action on *dry* litmus paper.) **IV**
- * 3. Prove that it can form a weak acid; that the acid so formed can dissolve carbonates, in particular calcium carbonate and magnesium carbonate. **IV**
- * 4. Illustrate the difference between hard and soft water. (St. Jos. Coll. Elem. Chem., No. 62.) **IV**
- * 5. Ascertain whether the tap-water at your disposal is hard or soft, and if hard, whether the hardness is temporary or permanent. Illustrate the method of softening hard water. **V**
- * 6. Transform some of the distilled water at your disposal into temporary hard water, thus illustrating how rain water may become hard. **V**
7. Test the tap-water or the well-water for the presence of gases and collect these gases. (Wilson and Hedley, p. 107.) **V**
8. Prepare a class experiment by which the quantity of solid matter contained in sea-water may be ascertained. **V**

22

43

XI

Requisites—

Two combustion tubes (surrounded with wire gauze if necessary), two alcohol lamps or Bunsen burners, glass tubing for connexion, two delivery tubes, graduated cylinder or gas-washing bottle of known capacity, graduated gas jar and trough, clean copper turnings, H apparatus, simple aspirator, balance, gas-holder with O, U-tube, condensing flask, copper oxide, lime-water, test-tubes, dry calcium chloride.

Agenda—

1. Show (roughly) how you would illustrate the volumetric composition of air. (Newth Chem. Lect. Exp., p. 114.) V

2. What would happen if only O were passed over heated copper in the previous experiment? Ascertain. * Hold a piece of thin copper foil in the extreme edge of a Bunsen flame for a few seconds: what happens to the metal, and why? V

3. Pass dry H over the heated copper oxide obtained in the previous experiment, and ascertain, if possible, the quantitative composition of water. Instead of H, you may pass a stream of the gas at your disposal, making it bubble through water in a gas-washing bottle. (Macnair, p. 68. Wilson and Hedley, p. 146. Newth, p. 110. St. Jos. Coll. Elem. Chem., p. 80). V

* 4. Show how you would reduce copper oxide by means of charcoal. (Wilson and Hedley, p. 147.) V

73 44

XII

Requisites—

Alum, mixture of alum and copper sulphate, boiling flask, 2 evaporating beakers, tripod, retort stand, test-tubes, evaporating basin, well-water, sea-water, distilled water, silver nitrate, soda-water, washing soda crystals, cobalt chloride, pyknometer, balance, retort and condensing flask, calcium chloride, Epsom salt, crucible with lid, sand-bath.

Agenda—

- * 1. Begin work by obtaining a well-defined crystal of alum from an intimate powdery mixture of alum and copper sulphate at your disposal. V
- * 2. Show practically the method of growing large crystals of alum. V
- * 3. From the above mixture separate a few crystals of copper sulphate and illustrate practically the fact that the *water of crystallisation* is necessary for the form the crystal assumes and sometimes for the colour of the salt. (St. Jos. Coll. Elem. Chem., No. 57.) Show further how in the case of copper sulphate the colour may be restored. V
- 4. Suggest and actually make experiments to illustrate the extraction of salt from sea-water, the way of transforming brine into fresh-water. (St. Jos. Coll. Elem. Chem., No. 59.) V
- 5. Point out to the class the different ways of distinguishing between 4 samples of water at your disposal: sea-water, well-water, distilled water (Nos. 60, 61, 62, 63), soda-water (what is soda-water?) Make the pupils note down the result of your experiments. V
- 6. Explain with the help of the substances at your disposal, the terms '*deliquescence*' and '*efflorescence*'. V
- 7. Ascertain whether Epsom salt contains water of crystallisation. Determine the amount of it roughly. (Perkin and Lean, p. 123.) V

74
45

XIII

Requisites—

Three-necked glass globe fitted for sparking air, condensing syringe, small Ruhmkorff coil, retort with condensing flask, tripod, nitre, strong sulphuric acid, lamp, sheet of copper, porcelain cup, test-tubes, saw-dust, paraffin, sulphur, tobacco-pipe, gas eprouvette and trough, green vitriol, potassium ferrocyanide, potassium carbonate, potassium hydroxide, lead nitrate, sodium chloride.

Agenda—

1. Illustrate the way in which nitric acid is formed in the air during thunderstorms, and the process by which nitre and calcium nitrate are formed in the soil. **V**

2. Prepare a sample of the acid and show its use (a) in copper engraving, (b) in removing mercury 'tails' which might remain after emptying a barometer tube. **IV**

* 3. Show its oxidising action on saw-dust and sulphur. (Newth, p. 191). Add some lead nitrate solution to the clear filtrate obtained in the latter case and account for the phenomenon observed. Illustrate also the oxidising action of nitric acid on green vitriol. (St. Jos. Coll. Elem. Chem., p. 188.) **V**

* 4. Show that lead nitrate and nitre are also oxidisers. What proof have you that nitric acid is reduced while it oxidises other substances? Explain what is meant by *oxidation* and *reduction*. **V**

5. Devise a means of obtaining oxygen gas from nitric acid. (Newth, p. 190.) **V**

* 6. Perform the experiment indicated in No. 143, St. Jos. Coll. Elem. Chem., which consists in 'showing that a silver coin contains copper.' **V**

XIV

Requisites—

Two flasks (4 oz.) fitted with India-rubber corks with a glass tube through them about 2 feet long, evaporating basin, strong infusion of blue litmus, lamp, ether, sodium chloride, sulphuric acid, ammonia (strong), 2 simple gas generators, 2 gas-washing bottles, zinc, manganese dioxide, silver nitrate solution, very weak nitric acid, very weak sodium hydroxide, pipette, blotting paper, quicklime, or slaked lime, calcium carbonate, ammonium nitrate, ammonium chloride, potassium chlorate.

Agenda—

- * 1. Show in *one* experiment the way of obtaining HCl gas, the physical properties of HCl gas (colourless, heavy, very soluble), the acid nature of HCl gas, the action of HCl gas on ammonia. IV

N.B.—The bubbles at first evolved from the apparatus are only air because (1) they leave the litmus unaffected, (2) they are not absorbed by water.

- * 2. Show likewise in *one* experiment the way of obtaining ammonia gas, the physical properties of ammonia gas (colourless, light, very soluble), the alkaline nature of ammonia gas, the action of ammonia gas on litmus reddened in the previous experiment by HCl. V

N.B.—As above.

- 3. Prepare a solution of HCl in water, a solution of ammonia gas in water. IV
- * 4. Bring ammonia gas in contact with HCl gas (in 2 test-tubes). Make some red and blue litmus papers (for directions see Perkin and Lean, p. 144). V
- 5. Illustrate the method of removing H from HCl by zinc, by MnO_2 . Compare the two results. IV

- 6. Show practically how chlorides are formed and detected. On what is the process based? V

- * 7. Treat CaO or $Ca(OH)_2$ with HCl, and elicit from the students an answer illustrating the points of resemblance and difference between this reaction and the action of HCl on $CaCO_3$. IV

- * 8. Rub some of the white powder obtained by the action of HCl on NH_3 , with CaO. What happens and why? What happens when it is heated with KOH and why? V

- * 9. Heat some of the same white powder or a crystal of sal ammoniac in a clean, dry test-tube and illustrate by this the meaning of the term '*Sublimation*.' V

- * 10. Contrast the action of heat on this substance with that on calcium carbonate, potassium chlorate, ammonium nitrate (portions of these substances may be heated by students in a clean, dry test-tube). V

76
47

XV

Requisites—

Strong HCl, MnO₂, 2 simple gas generators (to be fitted up), 2 gas jars for chlorine, gas-washing bottle, tubing, antimony powder, flowers, litmus paper or solution, turpentine, Dutch metal, ink.

N.B.—The following experiments should be made in a draught cup-board, or in a free supply of air.

Agenda—

1. Collect two jarfuls of chlorine gas. IV
2. Show its solubility by making some chlorine water for subsequent use. IV
3. Illustrate its bleaching action with blue litmus, flowers. Add chlorine water to ink. IV
4. Dip a piece of filter-paper soaked with warm turpentine into it.....a burning taper.....[a jet of H by means of a J-tube.....a jet of gasa piece of red-hot charcoal].
(*Cf.* Newth and St. Jos. Coll. Elem. Chem.) IV
5. Throw into the second jar some finely divided warm antimony powder.....some Dutch metal (brass). IV

27
48

XVI

Requisites—

Fragments of roll sulphur, test-tubes, 2 alcohol lamps or Bunsen burners, glass trough, glass plate, china cup, carbon disulphide, turpentine, nitric acid, sand-paper, bell-jar, flowers, Cu and Fe filings or fine thread, 4 flasks (4 oz.), tubing, large bottle for preparing sulphuric acid, sugar, potassium chlorate, amber, lead nitrate solution, iron persulphide, combustion tube with connexions, wide test-tube.

Agenda—

* 1. Ascertain by actual experiment, whether the following take place—Sulphur easily melts passing into a pale amber-coloured, mobile liquid. If at this stage it is allowed to cool in a crucible or a china-cup (pouring out what remains of the liquid as soon as a thin crust has formed on the surface), transparent, yellow needle-like crystals are obtained (prismatic sulphur). When further heated, say to 230°C , the liquid obtained at about 114°C (determine the temperature at which sulphur melts—Wilson and Hedley, I, p. 59), grows darker in colour and much thicker in consistency. If, while in this viscid state, it is poured into water, it becomes soft, elastic, resembling caoutchouc (plastic sulphur). If the heat be continued, say to 260°C , it becomes more liquid again, boiling at 448° , giving off deep yellow vapours which catch fire in oxygen or in air forming a pungent-smelling gas SO_2 . Fine iron or copper wire, heated in a flame, will combine with sulphur vapour, becoming incandescent in it and forming their respective sulphides.

IV

* 2. Although insoluble in water, sulphur forms sulphuric acid when heated for some time with water (test for H_2SO_4 with the help of lead nitrate).

V

* 3. Sulphur is more easily oxidised by HNO_3 and by KClO_3 . Devise experiments.

V

4. Roll sulphur (not flowers of S, nor plastic S) is easily soluble in CS_2 , from which it will crystallise (octohedral S). Pour the solution on a glass plate, and observe formation of crystals. [Sulphur is also soluble in turpentine forming a dark-brown solution by which the rusting of iron may be prevented. Try with the iron stand at your disposal, first cleaning, then gently heating, then painting it with the solution and gently heating once more.]

V

5. Illustrate the bleaching action of sulphur dioxide. (St. Jos. Coll. Elem. Chem., No. 92.)

IV

6. Prepare samples of iron and copper sulphides.

V

7. Fit up an apparatus to illustrate the formation of H_2SO_4 .

V

* 8. Suggest and actually make two or three experiments to illustrate the attraction of H_2SO_4 for water. Suggest an easy and practical remedy to counteract the action of H_2SO_4 on the skin. Explain and generalise this reaction.

IV

Water should never be poured on to strong H_2SO_4 . Why?

28
49

XVII

Requisites—

Yellow and red phosphorus, solution of phosphorus in carbon disulphide (to be prepared when required), glass trough, cotton wool (gun-cotton), bits of filter-paper, potassium chlorate, glass cylinder, long thistle funnel, oxygen gas, strip of brass about 20 cm. long and $2\frac{1}{2}$ broad, strong sulphuric acid, clay, lime-stone, different samples of silica, sandstone, large test-tube.

Agenda—

1. Show that phosphorus cuts as easily as hard wax, is easily ignited by friction (what helps the ignition in matches?), is self-luminous (hence its name), is easily oxidised (slow and quick oxidation illustrated by wrapping up some clean yellow P in cotton-wool and letting it slowly oxidise in air). IV
2. Pour some phosphorus solution on blotting-paper or on gun-cotton. What happens and why? (Greek fire.) V
3. The red variety bears moderate friction without ignition, does not dissolve in CS_2 , requires a much higher temperature to ignite. (Newth Exper., p. 234). IV
4. Phosphorus forms an oxide with acid properties, as proved by the fact that water in which P has been kept for some time has acquired acid properties. Ascertain the fact. V
5. Phosphorus may be made to oxidise and burn under water. Devise a means of your own to illustrate this fact. V
6. Bubble some oxygen gas through melted phosphorus kept under hot-water in a large test-tube. What happens and why? V
7. Show the class how to distinguish clay from limestone. IV
8. In the collection before you, pick out successively rock-crystal, flint, amethyst, quartz, agate, sandstone. V

79
50

XVIII

Requisites—

Potassium, sodium, glass basin (ordinary dinner plate will do), blotting-paper, red litmus-paper, bit of lead tubing (2 to 3 cm. long), gas jar, test-tubes, gas apparatus made with test-tubes and glass tubing (as for students), iron rod, iron gas pipe filled with clean iron turnings, tin water-boiler, connecting and delivery tubes, piece of zinc, copper sulphate, beaker, lamp or Bunsen burner.

Agenda—

1. Illustrate the difference in the behaviour of K and Na in contact with water. V
2. Show that in the case of Na the H may also be made to burn. V
3. Show how in the case of Na, the H evolved may be collected. [Make the students note down all the points of resemblance and of difference they have observed in following your experiments with K and Na.] V
- * 4. Zinc dropped into water evolves no H. It will, however, do so, when coated with Cu and heated. How would you coat it with Cu? See whether the above reaction actually takes place. V
5. Iron also, when red-hot, will decompose water (hissing noise produced). For practical purposes, however, this decomposition is done on a large scale by passing steam over heated iron. (Fit up an apparatus to show how this decomposition may be carried out.) V

80
51

XIX

Requisites—

Three student's gas generators, sodium chloride, strong hydrochloric and sulphuric acids, manganese dioxide, marble, test-tubes in stand, two china cups and holder, crystals of washing soda, distilled water, sticks of caustic potash, mortar and pestle crucible, lump of clay, lump of chalk, stick of plaster, gypsum, balance, ingredients of gunpowder.

Agenda—

1. Devise and actually make simple experiments to show how samples of the following substances may be obtained in the solid state: Glauber's salt, sodium bicarbonate, potassium chlorate,* potassium permanganate. V
- * 2. Make a sample of gunpowder. V
- * 3. Compare the action of water on limestone before and after calcining. V
- * 4. Actually illustrate in three different ways the difference between a lump of chalk and a stick of chalk (plaster of Paris). V
- * 5. Actually show how plaster of Paris is obtained from gypsum. V

81

52

TMENT

23

XX

Requisites—

Lead nitrate, copper sulphate, zinc plates, iron rod, charcoal, blow-pipe, red lead, metallic lead, copper turnings, mercuric chloride solution, balance, crucible with lid, retort stand, alcohol lamp or Bunsen burner, sand-bath.

Agenda—

- * 1. Suggest two ways of obtaining metallic lead from lead nitrate and actually prepare two samples of the metal. V
- * 2. By means of a zinc plate or an iron rod displace some metallic copper from copper sulphate. Weigh as accurately as you can the amount of copper obtained, and deduce from this the amount of zinc or of iron taken up by the solution. (Cu : Zn. Fe : 63 : 65 : 56). V
- * 3. Show that metallic lead can easily be oxidised into yellow litharge and that the red oxide of lead can also easily be reduced to the same compound. Prove, if you can, that lead becomes heavier by oxidation. What increase of weight do you notice? V
- * 4. Prove that copper can displace mercury from a solution of mercuric chloride. V

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