

UNIVERSITIES OF MANCHESTER LIVERPOOL LEEDS SHEFFIELD AND BIRMINGHAM

JOINT MATRICULATION BOARD



GENERAL CERTIFICATE OF EDUCATION

1966

REGULATIONS AND SYLLABUSES

GB

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(1,66)

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Certificate and Higher School Certificate Examinations in 1966. The Matriculation Examination proper was last held in 1937 and in 1951 the Ministry of Education introduced the Examination for the General Certificate of Education in place of the S.C. and H.S.C. Examinations. The Board continues to be the authority for determining and administering the examination requirements which must be fulfilled before entry upon a course leading to a first degree in any one of the five Universities.

The Board consists of thirty-two members, four appointed annually by each of the five constituent Universities and not more than twelve co-opted members being persons of experience in the practice or administration of education who are also appointed annually.

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JOINT MATRICULATION BOARD

GENERAL CERTIFICATE OF EDUCATION 1966

The regulations and syllabuses set out in the following pages will be subject to constant review in order to allow some degree of variation and experiment. Due notice of any major changes will be given (see page 3).

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On request from the Head of a school which is an approved centre for the Board's examinations copies of these *Regulations and Syllabuses* will be supplied by the Secretary without charge for the use of the staff. Copies may be purchased by candidates and others direct from **Messrs. John Sherratt and Son (Publishers), Park Road, Timperley, Altrincham, Cheshire**, price two shillings a copy (post free). *Regulations and Syllabuses* are NOT on sale from the Board's offices.

CHANGES IN SYLLABUSES

A summary of changes in syllabuses for 1966 is given on page 3.

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21.7.66

CALENDAR OF DATES

SUMMER EXAMINATION 1966

Last date for application for alternative papers for candidates of the Jewish faith.	1 January
Last date for the receipt of entries from external candidates .	15 February
Last date for the receipt of entries from internal candidates .	1 March
Oral Examinations, Practical Examinations and Written Examination.	April—June

SUPPLEMENTARY EXAMINATION 1966

Last date for the receipt of entries from external candidates .	24 September
Last date for the receipt of entries from internal candidates .	1 October
Oral Examinations, Practical Examinations and Written Examination.	November—December

Details of dates for 1966 will be announced later.

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EXAMINATION FOR THE GENERAL CERTIFICATE OF EDUCATION 1966

The Board's Examination for the General Certificate of Education is recognized by the Department of Science and Education as an approved examination and the certificates issued will be attested by the Department.

Attention is drawn to Ministry of Education Circular 251 (28 April 1952) which is concerned with the age limit upon entry to the General Certificate Examination and which requires that in normal circumstances candidates shall be at least sixteen years of age on 1 September in the year of examination. Correspondence and enquiries about the age limit should be addressed to the Department of Science and Education, not to the Board.

The Board retains to itself the interpretation of its Regulations.

CHANGES IN SYLLABUSES ETC.

Attention is drawn to the following:

1. The introduction of a third alternative (Alternative C) in Scripture Knowledge, Advanced, Paper II (page 79).

2. The revision of syllabuses in:

General Studies, Advanced (page 64)

Spanish, Ordinary (page 28)

Biology, Advanced (page 106)

Woodwork, Ordinary (page 50)

3. Amendments to the following syllabuses as indicated in bold type:

History, Advanced, Syllabus C, Alternative E (page 74)

Ancient History and Literature, Advanced (pages 74 and 75)

Scripture Knowledge, Advanced, Paper I, Alternative C (page 78)

Pure Mathematics with Statistics, Ordinary (page 35)

Botany, Advanced (page 104)

Zoology, Advanced (page 106)

Geology, Advanced (page 109)

Metalwork, Ordinary (page 52)

General Engineering Science, Ordinary (page 55)

Domestic Science, Ordinary (page 60)

4. The change in title to Human Biology, Ordinary of the subject previously called Physiology and Hygiene (page 50).

REGULATIONS

1. The Examination for the General Certificate of Education awarded by the Joint Matriculation Board of the Universities of Manchester, Liverpool, Leeds, Sheffield and Birmingham will be held in full once each year in June. A supplementary examination in certain subjects at Ordinary level only will be held in November and December.

SUMMER EXAMINATION

Internal candidates

2. (a) Internal candidates may be presented for the examination by schools approved by the Board and such candidates will sit at their own schools, excepting that certain oral and practical examinations will be arranged at the discretion of the Board. The Head of the school will be responsible for the proper conduct of such part of the examination as is held at the school and all matters relating to internal candidates will be dealt with through the Head of the school. The Board cannot entertain direct correspondence with internal candidates.

(b) The last date for the receipt of entries from **internal candidates** for the summer examination will be **1 March**. On payment of an additional late entry fee of **one pound** the entry of an individual internal candidate will be accepted up to noon on 15 March. If all the entries for a school are submitted after 1 March but before noon on 15 March the additional fee will be **five pounds**. No entries for the summer examination will be accepted on behalf of internal candidates after 15 March.

External candidates

3. (a) Candidates not presented by the Head of a school approved by the Board and not in attendance at such a school may enter as external candidates if they satisfy the requirement of the Ministry of Education as regards age. An external entry cannot be accepted from a candidate who is still in attendance at a school approved by the Board unless the entry is authorized by the Head of the school. External candidates are advised to consult the Chief Education Officer for the area in which they reside about accommodation for the examination.

(b) The last date for the receipt of entries from **external candidates** for the summer examination will be **15 February**. On payment of an additional late entry fee of **one pound** the entry of an external candidate will be accepted up to noon on 1 March. **No entries for the summer examination will be accepted from external candidates after 1 March.**

Local centres

4. In certain circumstances the Board is prepared to approve local centres; application for approval should be made to the Secretary. A list of local centres at which external candidates may be able to be accommodated on payment to the Board of an additional local fee is available on request.

Entry-forms

5. Internal candidates are to be entered on entry-forms submitted by the Head of the school and he will be requested to submit a School Estimate. External candidates must submit individual entry-forms which will be supplied by the Secretary and will make provision for indicating where the candidate has obtained permission to sit. No candidate may be entered both as an internal and as an external candidate simultaneously. Every candidate, whether internal or external, must be entered for the examination under one centre only.

6. The Board may at its discretion disallow work in any subject or paper for which a candidate has not been correctly entered.

Papers

7. Papers will be set (a) at the Ordinary level, (b) at the Advanced level. "Special" papers will also be set in certain Advanced subjects.

Subjects offered at the Advanced level need not have been previously offered at the Ordinary level.

When set "Special" papers will be on the syllabuses for the corresponding Advanced subjects. They will consist of questions of a more searching type, designed specially to test the candidate's intellectual grasp and capacity to think about the subject.

Schedule of subjects

8. Papers will be set in the subjects and at the levels indicated in the schedule on pages 10 and 11. Other subjects not included in this schedule may be submitted to the Board for approval. The application should include a detailed syllabus and the level, Ordinary or Advanced, at which the subject would be offered must be stated. Normally at least two clear years notice of such application will be required by the Board.

Syllabuses

9. The syllabuses on which papers will be set are given on pages 12 to 118. Schools may submit their own syllabuses for approval by the Board and in the summer examination papers will be set on approved syllabuses subject to payment of the required fee, as follows:

(a) For a paper at the Ordinary level: £3.

(b) For papers at the Advanced level: £4 for each 3-hour paper.

"Special" papers will not be set on syllabuses approved for individual schools.

Application for the approval of a syllabus must be made at least eighteen months before the examination concerned.

Combination of subjects

10. Any number or combination of subjects may be offered with the following exceptions only:

(a) The same subject may not be offered at one sitting both at the Ordinary and at the Advanced level.

(b) A "Special" paper may not be offered unless the corresponding Advanced papers are also offered at the same sitting.

(c) "Special" papers may not be offered in more than two subjects at the same sitting.

(d) Certain combinations of subjects may not be offered at one sitting as indicated in the schedule (pages 10 and 11).

Examination fees

11. For the 1966 summer examination fees have been *provisionally* fixed as follows:

(a) **Entry fee**, to be paid by every candidate: £1.

(b) **Subject fees**, additional to the entry fee under (a):

For each subject offered at the Ordinary Level: 10s. 0d.

For each subject offered at the Advanced level: £1. 10s. 0d.

For each subject in which "Special" papers are taken (additional to the Advanced fee): 15s. 0d.

(c) **Local fees**, in addition to fees under (a) and (b), to be paid by external candidates for accommodation at a local centre.

Amendments to entries

12. Special fees as follows will be charged in respect of amendments to existing entries received by the Secretary on or after **16 March**:

(a) When a subject is added to a candidate's existing entry, a special fee of £1 will be payable in addition to the appropriate subject fee.

(b) When an amendment involves the transfer of a candidate's entry from one subject to another, no refund will be made in respect of the entry which is deleted and the following fees will be charged:

(i) a special fee of £1, and

(ii) the appropriate subject fee for the new entry.

(c) When an amendment involves a candidate's change of alternative or paper within the same subject, the special fee of £1 only will be payable, except that when the amendment involves a change in alternatives in practical science subjects (Advanced) the Board, while reserving the right to impose it, may, at its discretion, waive this special fee.

Refund of fees

13. Fees will be refunded only under the following conditions:

- (a) If notice of the cancellation of an entry (or part of an entry) is received by the Secretary on or before **15 March**, the full fee (or the part of the fee concerned) will be returned.
- (b) If a candidate withdraws after that date or is absent from the whole examination, any excess from the entry and subject fees over £1. 10s. 0d. paid on his behalf will be returned after the end of the examination. No notification of such a withdrawal or claim for the balance of the fee is necessary or should be made. No refund of fee will be made in respect of absence from or withdrawal from only part of the examination.

In no instance will any of the following be refunded: (i) late entry fees (§§2 (b), 3(b)), (ii) the fee paid for a paper approved under §9, (iii) local fees (§11(c)), (iv) special fees payable in respect of amendments to existing entries (§12). No fee will be transferred from a previous examination or to a subsequent examination.

SUPPLEMENTARY EXAMINATION

14. A supplementary examination in certain Ordinary subjects of the General Certificate of Education will be held each year in November and December.

Internal candidates

15. (a) Internal candidates may be presented for the examination by schools approved by the Board and such candidates will sit at their own schools, excepting that (i) certain oral and practical examinations will be arranged at the discretion of the Board, (ii) if he so wishes, the Head of a school may make his own arrangements for his candidates to sit at some other school for all or part of the examination, any such arrangement being reported to the Board when the entry-form is submitted. The Head of the school will be responsible for the proper conduct of such part of the examination as is held at the school and all matters relating to internal candidates will be dealt with through the Head of the school. The Board cannot entertain direct correspondence with internal candidates.

(b) The last date for the receipt of entries from **internal candidates** for the supplementary examination will be **1 October**. On payment of an additional late entry fee of **one pound** the entry of an individual internal candidate will be accepted up to noon on 8 October. If all the entries for a school are submitted after 1 October but before noon on 8 October the additional fee will be **five pounds**. No entries will be accepted on behalf of internal candidates for the supplementary examination after 8 October.

External candidates

16. (a) Candidates not presented by the Head of a school approved by the Board and not in attendance at such a school may enter as external candidates if they satisfy the requirement of the Ministry of Education as regards age. An external entry cannot be accepted from a candidate who is still in attendance at a school approved by the Board unless the entry is authorized by the Head of the school. External candidates are advised to consult the Chief Education Officer for the area in which they reside about accommodation for the examination.

(b) The last date for the receipt of entries from **external candidates** for the supplementary examination will be **24 September**. On payment of an additional late entry fee of **one pound** the entry of an external candidate will be accepted up to noon on **1 October**. **No entries for the supplementary examination will be accepted from external candidates after 1 October.**

Local centres

17. In certain circumstances the Board is prepared to approve local centres; application for approval should be made to the Secretary. A list of local centres at which external candidates may be able to be accommodated on payment to the Board of an additional local fee is available on request.

Entry-forms

18. Internal candidates are to be entered on entry-forms submitted by the Head of the school. External candidates must submit individual entry-forms which will be supplied by the Secretary and will make provision for indicating where the candidate has obtained permission to sit. No candidate may be entered both as an internal and as an external candidate simultaneously. Every candidate, whether internal or external, must be entered under one centre only.

19. The Board may at its discretion disallow work in any subject or paper for which a candidate has not been correctly entered.

Papers

20. Papers will be set on all Ordinary syllabuses except that a General Paper will not be set and papers will not be set in languages other than Greek, Latin, French, German, Spanish, Italian and Russian. Optional Practical Examinations will not be held and papers will not be set on syllabuses approved for individual schools or groups of schools. No papers will be set on Advanced syllabuses. The question papers will not be published after the examination and copies will not be available on request. The papers set will be on the Ordinary syllabuses, set-books, periods, etc. for the summer examination of the year in question.

Number and combination of subjects

21. No candidate may offer more than three subjects in the examination. The subjects need not have been offered for examination previously. Any combination of subjects may be offered except for those combinations which may not be offered at one and the same sitting as indicated in the schedule on pages 10 and 11. (NOTE.—With regard to the number of subjects which may be offered the Board will exercise its discretion in respect of candidates entered for the preceding summer examination and prevented by illness from sitting. There can however be no transfer of fees.)

Examination fees

22. For the 1966 supplementary examination fees have been *provisionally fixed* as follows:

- (a) **Entry fee**, to be paid by every candidate: £1.
- (b) **Subject fees**, additional to the entry fee under (a):
For each subject offered: 10s. 0d.
- (c) **Local fees**, in addition to fees under (a) and (b), to be paid by external candidates for accommodation at a local centre.

Amendments to entries

23. Special fees as follows will be charged in respect of amendments to existing entries received by the Secretary on or after **10 October**:

- (a) When a subject is added to a candidate's existing entry, a special fee of £1 will be payable in addition to the appropriate subject fee.
- (b) When an amendment involves the transfer of a candidate's entry from one subject to another, no refund will be made in respect of the entry which is deleted and the following fees will be charged:
 - (i) a special fee of £1, and
 - (ii) the appropriate subject fee for the new entry.
- (c) When an amendment involves a candidate's change of alternative or paper within the same subject, the special fee of £1 only will be payable.

Refund of fees

24. Fees will be refunded only under the following conditions:

- (a) If notice of the cancellation of an entry (or part of an entry) is received by the Secretary on or before **8 October**, the full fee (or the part of the fee concerned) will be returned.

- (b) If a candidate withdraws after that date or is absent from the whole examination, any excess from the entry and subject fees over £1. 10s. 0d. paid on his behalf will be returned after the end of the examination. No notification of such a withdrawal or claim for the balance of the fee is necessary or should be made. No refund of fee will be made in respect of absence from or withdrawal from only part of the examination.

In no instance will any of the following be refunded: (i) late entry fees (§§15(b), 16(b)), (ii) local fees (§22(c)), (iii) special fees payable in respect of amendments to existing entries (§23). No fee will be transferred from a previous examination or to a subsequent examination.

GENERAL:

SUMMER AND SUPPLEMENTARY EXAMINATIONS

- Handwriting, etc.** 25. The Board's examiners in all subjects are instructed to penalize work the general presentation of which is negligent or slovenly.
- Notification of results** 26. The Head of a school presenting internal candidates will receive a report upon the performance of each of these candidates. This report is private to the school and is not for publication. Each external candidate will receive details of his results direct from the Secretary. No pass list will be published.
- Certificates** 27. Every candidate who satisfies the examiners in at least one subject will receive a certificate. The certificate will specify:
- the Ordinary subject(s) in which the candidate has satisfied the examiners;
 - the Advanced subject(s) in which the candidate has satisfied the examiners at the Advanced level and the grade (A, B, C, D, E) awarded in each such subject;
 - the subject(s) in which having attempted the Advanced level papers the candidate is deemed to have reached only the level required for a pass in that subject at the Ordinary level;
 - the "Special" paper(s) for his work on which the candidate is deemed worthy of the award of grade 1 or grade 2 *provided that* on the corresponding papers at the Advanced level he has reached at the same sitting of the examination at least the grade of C.
- A candidate who has already been awarded a General Certificate of Education by the Board and who is successful on a subsequent occasion will receive a supplement to the certificate first awarded.
28. Certificates awarded to internal candidates will be sent to the Head of the school. External candidates will receive their certificates direct from the Secretary.
- Certifying letters** 29. Certificates will be issued as soon as possible during the months following the examination. If official evidence is required before the certificates are available, it will be supplied direct to the institution concerned if application is made to the Secretary to the Board with full details. Certifying letters cannot be supplied direct to candidates and if the original certificate is available a certifying letter will not be issued. The Board makes no charge for the issue of certifying letters.
- Duplicate Certificates** 30. Duplicate certificates will be issued only if there is evidence satisfactory to the Board of the destruction of the original.

Disqualification

31. Every candidate is forbidden to introduce into the examination room any book, manuscript or other object or material not authorized by the Board, or to communicate in any way with or seek assistance from or give assistance to another candidate. A candidate suspected of using or attempting to use any unfair means, including copying or attempting to copy from the work of another candidate, will be reported to the Board. If the Board is satisfied that an offence has been committed, the candidate will be liable to be disqualified in the whole of the current examination for the General Certificate, including all such papers as may have been completed before and any papers worked after the session in which the offence was committed, as the Board in the exercise of its discretion may decide.

**Privileges
and
Exemptions**

32. Success in the Board's Examination for the General Certificate of Education is accepted by many institutions as satisfying in whole or in part certain of their examination requirements. Official information must be obtained direct from the appropriate officer of the institution concerned. Information is also given in Ministry of Education Circular 338 which may be obtained from H.M. Stationery Office.

UNIVERSITY AND OTHER AWARDS

33. In making their awards certain Awarding Bodies take into consideration the performances of candidates in the Board's Examination for the General Certificate of Education. Details of such awards and of the regulations governing them are to be obtained direct from the actual Awarding Body. External candidates are advised to communicate with the Chief Education Officer for their area. The Board itself does not offer Scholarships or make awards.

UNIVERSITY ENTRANCE REQUIREMENTS

34. Details of requirements for entry upon a degree course in any of the five Universities which constitute the Board are available on application to the Secretary.

SCHEDULE OF SUBJECTS OF THE G.C.E. EXAMINATION

35. The schedule of subjects of the examination is set out on pages 10 and 11. Details of the papers set in the Supplementary Examination are given in §20, page 7.

Subjects not included in this schedule may be submitted to the Board for consideration.

June 1964

SCHEDULE OF SUBJECTS

Subjects	Ordinary	Ad- vanced	Special	Notes	For syllabuses see pages
1. { General Paper General Studies	O —	— A	— —	General Studies (A) may not be offered with 1. General Paper.	12 64
2. English Language	O	—	—		12
3. English Literature	O	A	S		12, 65
4. History	O	A	S	History (A) Syllabus A, Alternative A may not be offered with 5. Ancient History and Literature.	13, 65
5. Ancient History and Literature	—	A	—		74
6. British Government	—	A	—		75
7. Geography	O	A	S		17, 75
8. Economics	O	A	S		18, 76
9. Commerce	O	—	—	Commerce may not be offered with 8. Economics.	18
10. { Book-keeping Book-keeping and Accounting	O —	— A	— —		19 77
11. Scripture Knowledge	O	A	S		19, 78
12. Art	O	A	S	Art (A) Paper III may not be offered with any of the subjects listed on page 80.	20, 80
13. Craft (Design and Practice)	O	A	—	Alternatives H and J may not be offered with 52. Needlework and Dressmaking.	21, 82
14. Music	O	A	S		24, 85
15. Greek and Roman Literature in Translation	O	—	—		26
16. Greek	O	A	S		26, 87
17. Latin	O	A	S		27, 87
18. French	O	A	S		28, 87
19. German	O	A	S		28, 87
20. Spanish	O	A	S		28, 87
21. Italian	O	A	S		28, 87
22. Russian	O	A	S		29, 87
23. Welsh	O	A	S	Two years' notice must be given if 23. Welsh is to be offered at the A level.	29, 87
24. Other approved languages	O	A	—	Application for other languages to be approved for examination at the A level must be made at least two years before the examination, at the O level at least one year before.	29, 87
25. Mathematics	O	—	—	25. Mathematics may be offered with one, and only one, of the O subjects 26, 28, 29. It may not be offered with 30. Commercial Mathematics or with any mathematical subject at A level.	29

Subjects	Ordinary	Ad- vanced	Special	Notes	For syllabuses see pages
26. { Pure Mathematics with Mechanics Mathematics (Pure Mathematics and Theoretical Mechanics)	O	—	—	At the O level only one of O 26, O 28, O 29 may be offered at one sitting.	35
	—	A	S		90
27. Further Mathematics (Pure Mathematics and Theoretical Mechanics)	—	A	S	At the A level the following combinations only are per- mitted: (i) A 26 with A 27; (ii) A 27 with A 28.	92
28. Pure Mathematics with Statistics	O	A	S	30. Commercial Mathematics may not be offered with any of subjects 25—29.	35 93
29. Pure Mathematics	O	A	S		36, 94
30. Commercial Mathematics	O	—	—		36
31. Physics	O	A	S		38, 95
32. Chemistry	O	A	S		40, 99
33. Physics-with-Chemistry	O	—	—	Physics-with-Chemistry may not be offered with any of the following: 31. Physics, 32. Chemistry, 38-9. General Science.	42
34. Botany	—	A	S	Botany may not be offered with 36. Biology.	103
35. Zoology	—	A	S	Zoology may not be offered with 36. Biology.	104
36. Biology	O	A	S	General Science may not be offered with any of the following: 31. Physics, 32. Chemistry, 33. Physics- with-Chemistry, 34. Botany, 35. Zoology, 36. Biology.	45, 106
37. Geology	O	A	S		46, 108
38. General Science I	O	—	—		46
39. General Science II	O	—	—		46
40. Agricultural Science	O	—	—		50
41. Human Biology	O	—	—	Human Biology may not be offered with 35. Zoology or 36. Biology.	50
42. Woodwork	O	A	—		50, 110
43. Metalwork	O	A	—		51, 111
44. Geometrical and Engineering Drawing	O	A	—		53, 113
45. Engineering Workshop Theory and Practice	O	—	—	Engineering Workshop Theory and Practice may not be offered with 43. Metalwork.	53
46. General Engineering Science	O	—	—		54
47. Surveying	O	—	—		57
48. Navigation	O	—	—		58
49. Seamanship, Signals and Rule of the Road	O	—	—		58
50. Domestic Science	O	—	—	Only one of O 50, A 51, A 52 may be offered at one sitting. Syllabuses B and C in O 50 may not be offered with Alt. J in 13. Craft.	59
51. Housecraft	—	A	—		114
52. Needlework and Dressmaking	—	A	—		116
53. Textiles	O	—	—		62

ORDINARY SUBJECTS

(O 1) GENERAL PAPER (one paper of three hours)

The General Paper may not be offered at the same sitting of the examination as General Studies (Advanced).

Although the paper ranks at the Ordinary level, it will be more suitable for candidates near the end of their Sixth-form or similar higher course.

Questions will be grouped round the following general headings, candidates being required to answer from each of the groups:

1. Current affairs, politics, economics, history and geography.
2. General science: science and its social implications, scientific method.
3. Literature including literary criticism; the fine arts (music, art, films, etc.).

Questions on religion and philosophy may be set in any section.

(O 2) ENGLISH LANGUAGE (one paper of two and a half hours)

Three papers, A, B and C, will be set of which a candidate may offer one.

Paper A. The paper will consist of four questions (Question 1, comprehension test based on a passage of prose; Question 2, essay; Question 3, test of the use and understanding of English; Question 4, test of the use of English based on a passage of either prose or verse). Candidates will be required to answer Question 1, Question 2 and **either** (a) all parts of Question 3 **or** (b) half of the parts of Question 3 (with complete freedom of choice) together with Question 4.

Paper B. The paper will be of the same general form as Paper A but will be framed with a view to the consideration that the main interests of candidates taking it may be scientific and technical rather than literary. Paper B may at the discretion of the examiners include a question based upon a passage of verse but any such question will be alternative to a question based upon a passage of prose.

Paper C. The paper will be framed to test candidates' ability to criticize, select from and use material which is given. The paper will consist of: (i) a comprehension test; (ii) a test such as the writing of a report or description or correspondence, the material being given; (iii) questions on sentence and paragraph structure and on the meaning of words and phrases involving selection from given material.

(O 3) ENGLISH LITERATURE (one paper of two and a half hours)

Two alternative papers will be set of which a candidate may offer one.

Paper A.

Three prescribed books. The books should be studied with some attention to detail though the use of notes should be subsidiary to first-hand knowledge of the text. Candidates should aim at appreciating the spirit of the books, their structure and style. Questions will be set to test candidates' knowledge of the subject-matter and the meaning of the texts.

Paper B.

Questions based on unseen passages of verse and prose will test the candidate's powers of judgment and appreciation. Questions will also be set to test the candidate's appreciation of central aspects of four set books. In illustration of these aspects the candidate will be expected to show first-hand knowledge of each book as a whole.

Prescribed for 1966

Paper A

1. Shakespeare, *Macbeth* **or** *Twelfth Night*

and

2. *Rhyme and Reason*, pages 79—95 and 119—134, O'Malley and Thompson, Chatto & Windus **or** Browning, *Before, After, My Last Duchess, Porphyria's Lover, A Grammarian's Funeral, Andrea del Sarto, Fra Lippo Lippi, The Statue and the Bust* (all as in *Tennyson and Browning*, Boas, Nelson) **or** Poems of Auden, Day Lewis, Roy Campbell, Frost, D. H. Lawrence, Macneice, Dylan Thomas (all as in *This Day and Age*, Hewitt, Arnold)

and

3. Swift, *Gulliver's Travels*, Books I, II and IV **or** Dickens, *David Copperfield* **or** C. Woodham Smith, *The Reason Why*, Penguin.

Paper B

1. Shakespeare, *Twelfth Night* or Wilde, *The Importance of being Earnest*
and
2. *Selected Poems of D. H. Lawrence*, Reeves, Heinemann or *Here Today*, pages 15—43 and
63—100, Hughes, Hutchinson
and
3. two of the following:
Crane, *The Red Badge of Courage*,
Flora Thompson, *Lark Rise*,
Conrad, *Typhoon* and *Youth*, Heinemann,
Hemingway, *The Old Man and the Sea*.

(O 4) HISTORY (one paper of two and a half hours)

Seven alternatives will be set of which candidates may offer one only.

Alternative A, Aspects of British and Foreign History from about 1500 to about 1939, is designed for those candidates who do not wish to study in a narrow field or a short period. The remaining alternatives, B to G, provide for a rather more specialised approach: alternatives B and C are on British history; in the other alternatives British and foreign history are considered in close relationship. In each alternative the syllabus is intended only as a general guide to the subject matter to be studied and questions may be set on topics which are not specifically mentioned. Each alternative will include questions designed to give candidates an opportunity of showing powers of critical argument or logical deduction appropriate to Ordinary level.

Candidates are advised in their preparation for the examination to make use of a good historical atlas.

Candidates wishing to offer a period of history not covered by Alternatives A to G may apply for a special paper. Application must be made at least eighteen months before the examination concerned and details of the period for study must be submitted for approval. No extra fee will be charged for any such special paper approved.

A. Aspects of British and Foreign History, from about 1500 to 1939.

Candidates will be required to have an outline knowledge of the major developments in British and foreign (including American) history from about 1500 to the outbreak of the second World War. A wide range of questions will be set but every major topic will not be examined in every paper. Candidates will not be required to cover the whole syllabus but will be offered a sufficient selection of questions to permit a certain chronological limitation of their studies (though not to less than two centuries). Alternatively several themes may be studied throughout the period. In British history major themes such as constitutional developments, foreign policy, economic and social changes, religious history and the growth of the Empire might be studied. In foreign history candidates might concentrate on the histories of two or three of the Great Powers. It must be emphasised, however, that this is a paper on *broad aspects* of British and foreign history and candidates should not specialise on too short a period of time or on fewer than three themes.

A brief note is given below of some of the major subjects suggested for study though this list is not intended to be exhaustive.

British History.

Sixteenth century. Age of discovery and overseas enterprise. The Reformation. The Tudor monarchy and parliament. The rise in prices and social changes.

Seventeenth century. Crown and Parliament under the first two Stuarts. The Civil Wars. Cromwell and the Protectorate. Nonconformity and the development of religious toleration. Charles II and James II. The Revolution of 1688—89. The wars with France. Farming, industry, trade and colonies.

Eighteenth century. Walpole and the Whig supremacy. George III and party conflicts. The wars with France and the revolt of the American colonies. The Younger Pitt. The agrarian and industrial revolution. Wesley and the rise of Methodism.

Nineteenth century. Foreign policies of Canning, Castlereagh and Palmerston. Parliamentary reform; economic and social reform (factory legislation, poor law, public health). The lives of Peel, Gladstone, Disraeli and Joseph Chamberlain. Ireland in the nineteenth century.

Twentieth century. The growth of the Welfare State. The origins and results of the first World War. Political and economic changes between the two World Wars. The rise of the Trade Unions and the Labour Party.

Foreign History.

Sixteenth century. The Renaissance. The Reformation. The Empire of Charles V. The Counter-Reformation. Spain under Philip II. France in the sixteenth century. The rise of the Netherlands. Suleiman the Magnificent and the development of the Ottoman Empire.

Seventeenth century. Richelieu, Mazarin and Louis XIV. The Thirty Years War. The Netherlands and her Empire. The War of the League of Augsburg. The War of the Spanish Succession. Scandinavia in the seventeenth century. The Great Elector and the rise of Brandenburg-Prussia. Russia under Peter the Great.

Eighteenth century. The peace settlement of Utrecht and attempts to upset it. The War of the Austrian Succession and the Seven Years War. The Enlightened Despots (Frederick the Great, Catherine the Great and Joseph II). France under Louis XV. The Partitions of Poland. The establishment of the United States. The French Revolution.

Nineteenth century. Revolutionary and Napoleonic Wars. The Vienna settlement. The Congress System and the Concert of Europe. Metternich and the Hapsburg Empire. France under the restored Bourbons and the Orleans monarchy. The revolutions of 1848. Bismarck and German unification. The Italian Risorgimento and Italian unification. The Eastern Question. France under Louis Napoleon and the Third Republic. Bismarck's system of alliances. The scramble for Africa. The development of Socialism. The United States; the westward movement, the problem of slavery, the Civil War, the period of reconstruction. The development of Latin America. Russia, China and Japan in the nineteenth century.

Twentieth century. The causes of the first World War. The Versailles peace settlement and the League of Nations. The rise of Japan. The revolutions of 1905 and 1917 in Russia. The establishment of the U.S.S.R. The U.S.A. in the twentieth century. Roosevelt and the New Deal. The rise of totalitarian states (Mustafa Kemal, Mussolini, Hitler, Franco). The causes of the second World War. Imperialism and the economic development of the Near East, Africa, South West Asia and Latin America.

B. The British Empire and Commonwealth, 1763—1939.

General topics

Distinction between colonies of settlement (mainly immigrants of British descent as in Australia) and colonies of exploitation (inhabited by native peoples as in India and Nigeria). Change from a dependent Empire to a self-governing Commonwealth. Economic development and trade between Britain and the Empire. Emigration. Problems concerning public land.

1763—1815

India. Clive's reforms 1765—66. North's Regulating Act, 1773. Warren Hastings. Pitt's India Act. Work of Cornwallis, Wellesley and Marquis of Hastings.

America. Causes of revolt of thirteen American colonies. American War of Independence. Empire Loyalists and Canada Act, 1791. Anglo-American war of 1812—13.

West Africa. Slave trade and campaign for its abolition.

Australia. Cook's voyage 1768—71. Botany Bay convict settlement 1788.

Expansion of Empire 1815. Ceylon, Cape of Good Hope, Malta, islands in West Indies.

1815—70

India. Reforms of Bentinck and Dalhousie. Afghan and Sikh wars. Causes, events and results of the Indian mutiny. Government of India Act, 1858.

Canada. Rebellions of 1837: Durham report. Canada Act 1840. Hudson Bay Company. New Provinces. Dominion of Canada Act, 1867.

South Africa. Abolition of slavery. The Great Trek and establishment of Boer republics. Annexation of Natal by Britain.

British West Indies. Insurrection in Jamaica, 1865.

Australia. Murray-Darling basin (MacArthur and sheep farming). Founding of Tasmania, South Australia, Victoria, Western Australia and Queensland. Gold rush in 1850s. End of transportation of convicts. Australian Colonies Act, 1850.

New Zealand. Treaty of Waitangi and work of Sir George Grey as Governor.

China. Opium Wars and opening up of China to trade.

1870—1939

General topics. Disraeli and the new Imperialism (Suez Canal shares, Cyprus). Work of Joseph Chamberlain at the Colonial Office (Imperial Preference). The Empire during the first World War and British mandated territories, 1919-39. The Ottawa Agreements.

India. Proclamation of the Queen as Empress, 1877. Rise of Indian nationalism. Work of Gandhi and Congress. The Morley-Minto reforms. The Simon Commission.

Canada. Additions to Federation after 1867. Growth of wheat production. The Klondyke gold rush. The Canadian Pacific Railway.

Australia. Australian Commonwealth Act, 1900.

Africa. Pioneer work of explorers (e.g. Livingstone), missionaries and traders. The scramble for Africa: Nigeria (Taubman Goldie and Lord Lugard), Egypt (Lord Cromer), Sudan, East Africa, South Africa (relations between Britain and the Boers, the Uitlanders, the Jameson raid, the Boer War, the Union of South Africa, the work of Botha and Smuts).

C. British Economic and Social History from the early eighteenth century to 1950.

An outline knowledge of the agrarian, industrial, commercial and social history of Great Britain will be expected together with some appreciation of its relationship with political and religious history.

(i) *Industrial and Agrarian Revolutions.* The major industries (coal, iron and steel, textiles). Water and steam power: the factory system. Transport: roads, canals, railways, shipping. Agriculture: enclosures, improved farming methods. Banking and monetary policy. Economic consequences of the Napoleonic wars. Development of Free Trade.

(ii) *Social results of the Industrial Revolution.* Growth of towns: public health and housing. Working conditions: factory and mines acts. Poor Law reform. Trade unionism.

(iii) *Later nineteenth century and twentieth century.* Growth of scientific and technical knowledge: changes in older industries and rise of new industries. Transport developments: roads, railways, shipping and air. Agricultural developments. Commercial and financial policy. Economic ideas. Social changes: education, trade unionism, emergence of the Welfare State.

D. The Renaissance and the Reformation, 1450—1600.

The history of England and the chief states in Europe should be covered in sufficient detail to make clear the main changes in politics, religion, thought and social life. Except where the affairs of smaller states impinge on those of the larger powers they need not be subjects for special study. Some of the following topics will extend beyond the period divisions.

1450—90

The arts, letters and science in Italy; the development of printing; the classical Revival; Geographical exploration and discovery.

The extension of the Ottoman Empire after the fall of Constantinople. The Empire under Frederick III and Maximilian. The consolidation of the French monarchy. The establishment of a united Spain by Ferdinand and Isabella. The Papacy and the Italian states. The Wars of the Roses; the New Monarchy (Edward IV and Henry VII) in England.

1490—1563

The condition of the Church at the end of the fifteenth century; movements for reform before 1500. The spread of the New Learning to Northern Europe. Erasmus. Luther and the Reformation in Germany. The Reformation in England under Henry VIII and Edward VI. The Counter-Reformation: Council of Trent. Jesuits. Inquisition. The Marian reaction in England. The wars of religion in Germany and France. The French invasions of Italy. The Empire of Charles V. Suleiman the Magnificent.

1563—1600

The expansion of overseas trade and the effects of the price revolution in England and Europe. The French monarchy and the reign of Henry IV. The Elizabethan religious settlement; Puritans; growth of Non-conformity; characteristics of Elizabethan England.

Philip II and Anglo-Spanish rivalry: the revolt of the Netherlands and the establishment of Dutch independence.

E. British limited monarchy and European autocracy, 1660—1789.

The period should be studied in sufficient detail to make clear the development of limited monarchy in Britain and the characteristics of autocracy in Europe as well as relevant changes in thought, religion, economic and social life. Except where the affairs of smaller states impinge on those of the larger powers they will not be subjects for special study.

British limited monarchy

Charles II: Restoration settlement; Clarendon; French policy of Charles II and opposition; Popish Plot; exclusion controversy; development of Whigs and Tories.

James II: Reasons for loss of throne; events in England, Scotland, Ireland 1688-90; the Revolution settlement.

William III and Anne: Powers of the Crown; Whigs and Tories; Act of Settlement; Union with Scotland.

Hanoverians: 1714 succession; Jacobite risings; Walpole; Chatham; growth of cabinet government; loss of American colonies; growth of demand for reform in parliament and administration; administration of Younger Pitt to 1793.

European autocracy

France: Louis XIV: the system of government; Colbert; religious policy. The Ancien Régime during the reigns of Louis XV and Louis XVI; attempts at reform; causes of the French Revolution. Russia: expansion and internal developments under Peter the Great. Brandenburg-Prussia: the Great Elector, Frederick I, Frederick William I. Enlightened despotism of Frederick the Great; Maria Theresa and Joseph II; Catherine II. The Jesuits. The French thinkers and their influence.

Major international events.

Louis XIV's foreign policy and the wars it provoked. The Spanish inheritance and the War of the Spanish Succession. Treaties of Utrecht and Rastadt. Changes in the settlement 1714-48. Great Northern War 1700-21. War of the Austrian Succession. Diplomatic Revolution. Seven Years War. Colonial warfare of England, France and Spain. Poland and the Partitions. The Eastern Question.

F. Revolution, Reaction and Reform, 1789—1870.

1789—1815

Great Britain: the wars with France; Tory governments and reaction; Ireland; the expansion of overseas empire; slavery. France: the Revolution; Napoleon; the Bourbon restoration. Napoleonic Europe. Prussia after Jena. The Peninsular War. The United States: Washington to Jefferson; the war of 1812; coalitions and the war of liberation.

1815-48

Great Britain: post-war repression; Tory and Whig periods of reforms; Peel's great ministry; Ireland. Colonial expansion. France under the Bourbons and Louis Philippe and the Second Republic. The settlement of Europe and the Congress system: Metternich and the German Confederation. Belgian independence. The Eastern Question. Greece. Mehmet Ali. Insurrections in Italy, Spain and Poland. The United States: Jackson's Presidency; Western expansion; Mexico and Texas; slavery.

1848-70

Great Britain: Palmerston; economic expansion; expansion of empire overseas; Ireland in trouble. France: the collapse of the Second Republic; Louis Napoleon. Central Europe and the failure of liberal revolutions; reaction. Prussia: Bismarck's building of the Prussian leadership of Germany. Russia: Alexander II and reforms. The Eastern Question. The unification of Italy. The United States: the civil war; Abraham Lincoln.

G. The Great Powers, 1870—1939.

Relations between the following Great Powers: Austria-Hungary, Britain, France, Germany, Italy, Japan, Russia, U.S.A. A knowledge of the domestic affairs of these powers will be required only where it is necessary to an understanding of international affairs.

1870—1914

The Dual Monarchy; internal divisions of Austria-Hungary. Franco-Prussian War. The German Empire: industrial and commercial development: Bismarck's foreign and domestic policies; imperial policies of William II. The Far East: emergence of Japan; interests of the Great Powers in China; the consequences of these two factors. The effect on international relations of the colonisation of Africa. The British Empire. The Third French Republic and its difficulties. The Tsarist regime in Russia and opposition to it; social and economic reforms. The Eastern Question. The end of Britain's "splendid isolation"; Grey's foreign policy. The Armed Camps. Causes of the first World War. The Socialist Internationals; Socialism in France and Germany; Liberal reforms in Britain; the Labour Party. U.S.A.: development of foreign interests; the Spanish War; Latin America; relations with Europe.

1914—19

Main features of naval and land campaigns of the first World War. American intervention. Defeat of the Central Powers. Break-up of the Ottoman and Austro-Hungarian Empires. Revolution in Russia: the civil war; Lenin.

1919—29

Peace treaties of 1919—20. Post-War settlement of the Middle East and European interests there. Turkey and Kemal Ataturk. The League of Nations: organisation, achievements and attempts to strengthen it. The Fascist state in Italy. The Weimar Republic and its problems; Stresemann. The Locarno Pact. Britain's domestic problems as a background to her European policies. America's withdrawal at Versailles; her economic influence in Europe.

1929—39

The World Depression and its effects; the rise of Hitler; economic and social difficulties of Britain; the New Deal. The Nazi state in Germany. The challenge to the League by the totalitarian powers; policies of France and Britain. The Spanish Civil War. Causes of the second World War. U.S.S.R.: Stalin; relations with the West. Britain and the Commonwealth. The Far East.

(O 7) GEOGRAPHY (PHYSICAL, ECONOMIC AND POLITICAL) (one paper of two and a half hours)

The examiners may set questions on any part of the syllabus which involve the interpretation of a photograph.

1. *Elements of World geography.* Distribution of land and water. Major features of world relief. Land forms. The factors which determine climate. Distribution of temperature, winds, rainfall, ocean currents and their relation to the distribution of natural vegetation and animal life. Modes of life (i.e. social and economic aspects of human activities) and their relation to physical and biological conditions.

2. *Regional geography.* The following to be studied so as to indicate the regional application of the subject matter of 1:

(a) The British Isles.

(b) Areas from the several continents of special importance in the economic and political life of our time. The questions asked will not demand comparisons of areas drawn from different continents or a study of all the regions of any one continent. It will not be necessary for candidates to study every continent in order to satisfy the examiners in this part of the paper.

3. *Map-reading.* The elements of map-reading as illustrated in Ordnance Survey maps. (The use of a hand-lens for map-reading is permitted in the examination. The examiners will not necessarily confine themselves to questions on 1-inch maps.)

Wherever appropriate, simple sketch-maps are to be drawn as integral parts of the answers.

(O 8) ECONOMICS (one paper of three hours)

Economics may not be offered at the same sitting of the examination as Commerce.

Although the subject ranks at the Ordinary level, questions set will be more suitable for candidates who have already completed at least part of their Sixth-form or similar higher course.

1. General descriptive economics: e.g. agriculture and its problems; the major British industries; commercial organization; elementary treatment of banking, taxation and balance of payment.

2. Outline of economic theory: e.g. wants and their satisfaction; diminishing utility, elasticity of demand; division of labour; the market, supply and demand; price determination under competition, and elementary treatment of imperfect competition; the National Income and its distribution: rent, wages, interest, profits.

(O 9) COMMERCE (one paper of two and a half hours)

Commerce may not be offered at the same sitting of the examination as Economics (Ordinary or Advanced).

The examiners will be at liberty to set arithmetical questions where appropriate.

1. Background study. Human needs and their satisfaction; specialization and exchange; markets; the interdependent community. The classification of productive activities—industry, commercial services, direct services. The divisions of Commerce.

2. Retail trade. The growth and development of retailing; functions and services of the retailer. Types of retail businesses—single shops, multiple shops, departmental stores, retail co-operative societies, mobile shops, markets, mail order businesses.

The shop and its clientele—the site, shop equipment, layout and services. Cash and credit sales, hire-purchase, deferred payments, club-trading.

Sources of supply: contacts with manufacturers and wholesalers; procedures in purchasing stock—terms of purchase, trade discounts, “mark-ups”, credit facilities. The documents and communications used between the retailer and the supplier—e.g. price-lists, orders, despatch notes, invoices, debit and credit notes, statements.

Control of the business: raising of capital, the inter-relationship of capital turnover and profit. Stock records, seasonal “sales”.

3. Business risks and methods of covering them by insurance.

4. Trade organizations such as Chambers of Commerce. The functions of the Stock Exchange and produce markets.

5. The wholesale trade. The functions of the wholesaler and his services to producers and retailers; general warehouse organization.

6. Foreign trade. The nature, extent and general pattern of the overseas trade of the United Kingdom. Outline of the general procedure in the import and export of goods.

7. Broad relationship between Government Departments and the country's trade and commerce.

8. Transport. The effect of the development of transport upon markets and marketing; forms of transport for goods and passengers and their relative merits. Factors influencing the trader in the choice of transport services.

9. The means of payment. Money as a medium of exchange; transfers of money and credit through the Post Office and the Banking System. The form and meaning of the documents used, e.g. postal orders, money orders, cheques, bills of exchange. The general services of the Banks to traders.

(O 10) BOOK-KEEPING (one paper of three hours)

1. The principles of book-keeping. Theory and practice of double entry.
 2. The ledger, cash book (three columns), journal, purchases book, sales book, purchases and sales return books. Trial balance.
 3. Bank reconciliation statement. Petty cash imprest system. Columnar petty cash book.
 4. Partners' capital, salaries, drawings, interest on capital, current accounts.
 5. Trading account, profit and loss account, balance sheet. Goodwill, provision for depreciation, discount, bad and doubtful debts.
- Pre-payments and accrued expenses in connection with the books of a sole trader and a partnership.

6. The simpler aspects of company final accounts, including a knowledge of types of share, debentures, calls in arrear, premium on shares and preliminary expenses.

7. The accounts of non-profitmaking organizations. Receipts and payments accounts, income and expenditure accounts and balance sheets.

Candidates will be expected to be familiar with the more common documents and terms within the scope of the syllabus. The purpose of keeping any particular form of account should be stressed throughout.

(O 11) SCRIPTURE KNOWLEDGE (one paper of two and a half hours)

Four alternative papers will be set each year. Candidates may offer one, and only one, of the alternatives. There will be no compulsory context question but questions will be included which are set directly upon the text of the Bible, particularly that of passages recommended for study. The passages should be studied not as isolated and complete in themselves but with reference to earlier religious thought and later biblical teaching.*

Either

A. The making of the nation from the Exodus to the division of the Kingdom.

A general knowledge of the historical background and of the development of religious thought as illustrated by the following passages:

Exodus i—xx 17, xxiv—xxv 9, xxxii—xxxiv; Numbers xiii—xiv; Deuteronomy xxxiv; Joshua i—xi, xxiii—xxiv; Judges i—xvi; I Samuel i—xii, xvi—xx, xxiv, xxvi, xxviii, xxxi; II Samuel i—iii 1, v—vii, ix—xviii; I Kings i—v, viii—x, xi 26—xii.

Or

B. The rise and development of prophecy from Elijah to Jeremiah.

A general knowledge of the historical background and of the development of religious thought as illustrated by the following passages:

I Kings xvii—xix, xxi, xxii; II Kings ii—vii, ix, x, xvi—xxv; Amos; Hosea i—vii, xi, xiv; Isaiah i, ii, v—ix, xi, xxix—xxxii; Jeremiah i, vii, xviii—xx, xxiii, xxiv, xxvi—xxxix, xxxi 27—34, xxxvi.

Or

C. The life and teaching of Our Lord as recorded:

- (i) in the Gospel according to St. Mark,
- (ii) in the following prescribed portions of the Gospels according to St. Matthew and St. Luke:
 - (a) His Nativity and Childhood: St. Matthew i—ii, St. Luke i—ii.

* The text used for such questions will be that of the Revised Version. Papers on Alternatives C and D will however be set each year in both the Douai Version and the Knox Version without notice being given. Papers on Alternatives A and B will be set in the Douai Version and the Knox Version if notice is given by 1 December preceding the examination. No extra fee will be charged but for examination purposes schools not using the Revised Version will be expected to restrict their candidates to **either the Douai Version or the Knox Version.**

- (b) The Mission of John the Baptist and the Temptations of Jesus: St. Matthew iii—iv, St. Luke iii—iv.
 (c) The Sermon on the Mount: St. Matthew v—vii.
 (d) The Teaching Ministry of Jesus: St. Matthew xiii, xviii, xx, xxv, St. Luke vii, x—xix.
 (e) The Passion and Resurrection: St. Matthew xxvi—xxviii, St. Luke xxii—xxiv.

Candidates will also be expected to have some knowledge of the general background of the subject, e.g. the political situation in Palestine at the time of Our Lord, the main Jewish parties, the outlines of Jewish worship and the Messianic Hope.

Or

D. The rise of the early Christian church.

A general knowledge of the historical background as illustrated in the Acts of the Apostles and in the following passages from the Epistles: I and II Thessalonians; Galatians i, ii; I Corinthians i—iii, viii—xv; II Corinthians viii, ix; Philippians; Philemon; I Peter; I Timothy iii—v.

(O 12) ART

Four papers, each of two and a half hours, will be set of which a candidate will be required to offer any two.

In all papers the method of working and the media used will be left to the candidate's choice except that work in oils will not be accepted.

Half-imperial drawing paper may be used for Papers I and II if centres wish to provide it. The Board will supply quarter-imperial sheets for Papers I and II and special answer-books for Papers III and IV.

In Papers I, II and III candidates will have freedom to interpret the questions in terms of their own personal experience. They should show evidence of the ability to understand and use structural principles and the qualities of shape, line, tone, texture, colour and space. The work set in the examination will be concerned with:

- (i) Personal environment.
- (ii) Natural and man-made objects known to the candidate.
- (iii) Human and animal forms.

I. *One* of the following:

- (a) A figurative composition.
- (b) A non-figurative composition.
- (c) An arrangement of lettering.

Four questions will be set on (a) and two on each of (b) and (c).

II. A study or studies of *one* of the following:

- (a) Natural forms, i.e. organic or inorganic matter in any form.
- (b) Objects in common use, either singly or in a group. (Alternative exercises will be set.)
- (c) The human figure, in **either** (i) a study occupying two hours followed by one occupying half an hour **or** (ii) a series of short studies.

III. The appreciation of design in the present day as affected (a) by human needs, (b) by materials and processes. Four questions will be set on each of the following: dress, home furnishings, the immediate environment of the home, transport. Candidates will be required to answer four questions which may be chosen from any part of the paper.

IV. History and appreciation of architecture and painting.

One of the following:

Either

(a) *History and appreciation of English architecture from Norman times to the present day.*

The characteristic features of English architecture at different times. The causes underlying styles of architecture. The commonly accepted stylistic classification; while a detailed knowledge of ornaments, mouldings etc. will not be required candidates will be expected to be able to illustrate the outstanding features of each style.

Basic structural principles of architecture and of such elements as beam, arch and cantilever as applied to walls, floors, openings, roofs and vaults. An appreciation of the use at different times of common building materials such as stone, timber, steel, concrete and glass.

The common arrangements of plans for dwellings, churches, castles and other buildings. The influence of planning requirements on architectural development up to the present day.

Candidates will be given the opportunity of showing evidence of having studied actual examples of everyday architecture such as homes, churches, chapels, factories and schools, as well as buildings of outstanding architectural merit.

Or

(b) *History and appreciation of painting.*

The question paper will consist of three sections. Candidates will be required to answer questions from at least two sections, one of which must be Section (3).

While questions specifically relating painting to sculpture or other fine arts will be set in Section (3), candidates will receive credit throughout the paper for apposite reference to arts other than painting and to the times in which the artist worked.

Prescribed for 1966

Section (1)

- (a) Painting in Florence 1400—1475.
- (b) The High Renaissance 1475—1550.
- (c) Central Italian Painting 1275—1350.

Section (2)

- (a) Painting in France 1850—1900.
- (b) Painting in England 1750—1875.
- (c) Painting in Germany 1450—1550.

Section (3)

- (a) European painting 1900 to the present day.
- (b) General appreciation.

(O 13) CRAFT (DESIGN AND PRACTICE) (one paper of two hours and a practical examination)

Alternatives H and J may not be offered at the same sitting of the examination as Needlework and Dressmaking (Advanced).

Alternative J may not be offered at the same sitting of the examination as either Syllabus B or Syllabus C in Domestic Science (Ordinary) or Paper III in Art (Advanced).

Nine alternatives will be set each year. Candidates may offer one, and only one, of the alternatives.

A. LETTERING AND CALLIGRAPHY

History

Origins of letter forms. Appreciation of the design and function of writing and lettering as exemplified in Greek and Roman majuscule forms and in miniscule forms, uncials and half-uncials, as developed in the British Isles.

Earliest developments of printing in England.

Methods

Incised, painted or drawn, pen-made letter forms; tools and materials in each case. Preparation of designs; pen and letter sizes, line spacing, margins. Methods of colouring and decoration.

Practical Examination (three hours)

Execution of M.S. page designs; arrangements of drawn letters; illumination and decoration of single letter-forms.

B. STAGE DÉCOR AND COSTUME

History

An outline of the history of the theatre in England.

Methods

Stage forms, open and enclosed. Lighting, internal and external to stage. Types of construction of characteristic settings; materials. Construction of flats and properties. Visual angles, masking, borders. Stage dress; materials in common use.

*Practical Examination (four hours)***Either**

(i) Design of settings for **either** actual **or** imagined scenes, using diagrammatic and working drawings and colour elevations.

Or

(ii) Design of costumes and accessories; expressive and explanatory drawings.

Or

(iii) Design and making of puppets or marionettes; construction and clothing.

C. PICTORIAL CRAFTS

History (one of the following topics will be prescribed each year)

(i) An outline of English book illustration to the end of the nineteenth century.

(ii) An outline of twentieth-century English book illustration.

(iii) An outline of children's book illustration in England.

Prescribed for 1966

An outline of twentieth-century English book illustration.

Methods

Wood engraving, lino cut, lithography: nature and use of materials; grains and surfaces; tools and implements; proper use and maintenance.

Inks, chalks and papers. Types of press. Standard paper sizes. Preparation of blocks, plates etc. for printing. Proofing processes.

Practical Examination (four hours)

Sketch suggestions and execution of prints intended for illustration or for simple forms of graphic design in one or two colour printings.

D. POTTERY

History

An outline of the history of English pottery.

Methods

Bodies and glazes; nature and characteristics. Hand methods of making pots; thrown, moulded and coiled forms; slab-ware. Methods of decoration. Firing; behaviour of bodies and glazes. Tools and implements in common use.

Practical Examination (five hours)

Sketch suggestions and execution of simple glazed pottery shapes, plain or decorated. (Under supervision (i) during making and (ii) during application of glaze, with adequate time allowance for drying and firing.)

E. MODELLING AND CARVING

History

An outline of the history of English modelling and sculpture.

Methods

Nature and use of materials; wood, stone, clay, plaster. Tools and equipment. Simple armatures. Surface treatments; polishes and colourings.

Practical Examination (four hours)

Sketch suggestions and execution of small modelled or carved forms, animals, heads, single figures etc., in the round or in relief. Work may be submitted in the form of fired clay or plaster casts. If the latter is employed, casting will not be assessed and assistance in casting may therefore be given to the candidate if required.

F. WEAVING

History

An outline of the history of weaving in Britain.

Methods

Raw materials: silk, wool, cotton, flax and man-made fibres. Spinning, doubling, fancy yarns. Yarn counts: estimation of quantities. The loom and its parts (not to exceed four shafts). Preparation of the loom: warping, beaming, denting etc. Drafting on four shafts: relation of the drafts to parts of the loom. Simple weaves: plain or tabby, twill, basket, repp etc.

Practical Examination (four hours)

Sketch suggestions for colour and weave effects on half-imperial paper in any medium. Preparation of drafts. Practical weaving of more than one pattern on a prepared warp.

G. FABRIC PRINTING

History

A general outline of the history of fabric printing in Europe.

Methods

Methods of printing: block, screen, machine. Styles of printing: direct, discharge, resist. Preparation of hand printing media: wood and lino blocks and screens. Dyestuffs and after-treatment of prints. Types of repeat: relationship of repeat to cloth width, purpose and method of printing.

Practical Examination (four and a half hours)

Sketch-designs and execution of a small quantity of printed cloth by a block or screen. Tests under supervision (i) during design and **either** cutting of the block **or** lacquering **or** french polishing of the screen and (ii) during printing.

H. EMBROIDERY

History

Current practice in embroidery together with a study of English embroidery in a prescribed period.

Prescribed for 1966

English embroidery from 1600 to the present day.

Methods

Essential tools. Materials and their uses. Transference of designs to different materials. Methods of work: appliqué, canvas work, white work, cut work etc. Stitches employed: running, stem, loop, herring bone etc.

Practical Examination (four hours)

Designs for small units of embroidery and preparation for their execution in material. Execution of part of a design, entailing the selection of materials.

J. DRESS

History

The history of English costume in a prescribed period.

Prescribed for 1966

English costume 1560—1800.

Methods

Factors governing design: occasion, wearer, material fashion, recurrence of style. Tools and equipment. Materials in common use: their qualities and behaviour. Planning and practical cutting by drafting or modelling of pattern. Layout of pattern on material. Assembly by hand and machine. Pressing and finishing.

Practical Examination (four hours)

Sketch-designs which are readable and practical for everyday garments including lingerie; the cutting and construction of the whole or a specified portion of one of these sketch-designs, in toile.

(O 14) MUSIC (one paper of three hours and a practical examination)

Credit will be given for good musical handwriting.

1. *Four-part harmonic writing*

Triads of major and minor keys in root position and first inversion. Second inversions of primary triads. The dominant seventh in root position. Unaccented diatonic passing-notes and auxiliary notes. Modulation and chords using the melodic minor will not be required.

The above may be understood to include the following:

- (a) the harmonization of a short, simple melody,
- (b) the writing of simple chord progressions,
- (c) the writing and correct barring of simple cadences,
- (d) the insertion of specified chords, at various points, in a short passage.

2. *Two-part contrapuntal writing*

The addition of a contrasted melody above or below a given melody, at the discretion of the examiner. The test will be not more than eight bars in length and will be based on the requirements shown under 1. above.

3. *Melodic writing*

The continuation of a given fragment so as to make a regular sixteen-bar melody, including a modulation to the dominant or relative major and showing some thematic development.

4. *Melodic analysis*

The phrasing of a given melody (which may be irregular) and the answering of questions on its structure.

5. *Prescribed works*

(i) The analytical study of a pianoforte sonata by Beethoven or Mozart. A copy of this work must be brought to the examination room by each candidate. It must be free from marks or annotations except for the numbering of bars; all notes, analyses, advertising matter etc. which may be included in it must be removed or efficiently obscured. The numbering of bars is to begin with the first *complete* bar of each movement and, where there is a repeat with "first time" and "second time" bars, those bars are to be numbered with corresponding numbers, e.g. 59a, 59b.

(ii) A study of **two** prescribed works in relation to the life and work of the respective composers and the period in which each lived. Simple questions may be asked on the form and structure of the prescribed works and on the instruments used in prominent passages of an orchestral work. Candidates will be expected to show an acquaintance with other well-known works by each composer and by the contemporary composer or composers specified under each heading and to be able to quote important themes from these works.

Prescribed for 1966

Compulsory work for analytical study.

1. Mozart, Sonata in F major, K.533.

Two of the following works for study in relation to the life and work of each composer and of the contemporary named.

2. Beethoven, Symphony No. 1 in C major (movements 1 and 2), Miniature Score No. 108, Boosey & Hawkes.

Contemporary composer: Weber.

3. Mendelssohn, *Elijah*, Nos. 10, 11, 12, 13, 14, 20, Vocal Score, Novello.

Contemporary composer: Berlioz.

4. Grieg, Holberg Suite for Strings, Op. 40, Miniature Score No. 897, Eulenburg.

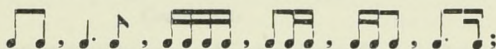
Contemporary composer: Tschaikowsky.

For the written paper candidates are to bring to the examination room copies of Mozart's Sonata in F major.

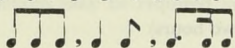
Practical Examination

Tests in sight singing and dictation may be in 2/4, 3/4, 4/4 or 6/8 time and may use the following time patterns in addition to pulse notes and notes lasting for two or more pulses:

in simple time



in compound time



They will not be more than four bars in length. They may be in any major or minor key, but will not contain chromatic notes or modulation.

1. **Either** (a) *Sight singing*

(i) Two rhythms, four bars long, one in simple and one in compound time; (ii) two series of five notes, one series in a major key and one in a minor; (iii) a melody four bars long. Two attempts will be allowed for each test and in (ii) and (iii) the tonic chord, with the tonic at the top, will be sounded by the examiner before each attempt.

Or (b) *Sight playing*

Two very short and simple piano pieces. Two attempts at each piece will be allowed.

2. *Dictation*

Each of tests (a), (b), (d) will be played straight through four times; test (c) will be played straight through five times. There will be an interval of at least half a minute before each repetition. The key will be named by the examiner and the tonic chord sounded, with the tonic at the top, before each playing of the tests. In tests (a) and (c) the time signature will be given and two specimen bars counted before they are played for the first time.

(a) *Rhythm*. Two tests, one in simple and one in compound time. Each will be played as a melody but the candidate will be required to write the rhythm only on one note.

(b) *Pitch*. Two tests, each of five notes, one set in a major key and one set in a minor. They will be played rhythmically but the candidate will be required to write only the pitch of the notes.

(c) *Melody*. Four short and simple bars in a major or minor key, simple or compound time.

(d) *Harmony*. Five chords in four-part harmony. Candidates will be required to write down the melody and the bass and to name the chords. The first of the five chords will be the tonic in root position and the chords will be limited to those specified for the three-hour paper under 1. *Four-part harmonic writing*.

(O 15) GREEK AND ROMAN LITERATURE IN TRANSLATION (one paper of two and a half hours)

Questions on Classical literature, history, life and thought arising from the study in translation of prescribed Classical texts. The translation should be studied with some attention to detail. Questions will be set to test the candidates' appreciation of the spirit of the books and their structure as well as knowledge of the subject-matter and meaning.

Six texts will be prescribed each year, three for detailed study and three for more general reading. Context questions will be set only on texts prescribed for detailed study and will be compulsory.

Prescribed for 1966

Section (1)

For detailed study

1. Aeschylus, *Agamemnon*, tr. Murray, Allen & Unwin.
2. Plato, *Republic* i (as in Cornford, *The Republic of Plato*, Oxford).
3. Tacitus on *Imperial Rome*, pages 274—309 (i.e. *Annals* xi), tr. Grant, Penguin Classics.

Section (2)

For general reading

4. Herodotus vii and viii.
5. Lucretius, *The Nature of the Universe* i—iii, tr. Latham, Penguin Classics.
6. Virgil, *Aeneid* x—xii, tr. Jackson Knight, Penguin Classics.

(O 16) GREEK (two papers each of two hours)

- I. (a) Two passages for unseen translation from Greek.
- (b) Simple sentences for translation into Greek.
- (c) A passage of prose for translation into Greek.

II

- (a) *Prose*

Either

A passage for unseen translation from Greek with questions on accidence and syntax arising from the passage.

Or

Two passages of translation from a prescribed book; candidates will be required to translate both passages. The paper will include questions on the language of the prescribed book.

- (b) *Verse*

Either

A passage for unseen translation from Greek with questions on accidence and scansion arising from the passage.

Or

Two passages of translation from a prescribed book; candidates will be required to translate both passages. The paper will include questions on accidence and scansion.

Candidates who offer Homer will be expected to parse and give the Attic equivalents of Homeric forms of common occurrence, but of these only.

Prescribed for 1966¹

1. Xenophon, *Anabasis* iii, cc. 1—4 **or** Thucydides iv, cc. 2—16, 21—23, 26—40, Graves, Macmillan

and

2. Homer, *Odyssey* x (omitting lines 1—79 and 551 to end) **or** Euripides, *Iphigenia in Tauris* (as in *Scenes from Euripides' Iphigenia in Aulis and Iphigenia in Tauris*, Kennedy, Macmillan).

¹ Unless a special edition is prescribed, the text used by the examiners in selecting extracts for questions on prescribed books will be that of the Oxford Classical Texts with such modifications of spelling as may seem to them desirable.

(O 17) LATIN (two papers each of one and a half hours)

- I (a) A prose passage for unseen translation from Latin.
 (b) Short sentences for translation into Latin. Each sentence will involve not more than one subordinate clause.
 (c) A short passage of prose for translation into Latin.
- II (a) A prose passage for unseen translation from Latin with questions on accidence and syntax arising from the passage.
 (b) **Either**
 (i) A verse passage (hexameter or elegiac) for unseen translation from Latin with questions on scansion arising from the passage.
Or
 (ii) A verse prescribed book on which will be set
 (1) a passage for translation,
 (2) a passage or several brief passages to test knowledge of subject-matter and grammar,
 (3) questions on scansion.

Prescribed for 1966¹

Virgil, *Aeneid* ix, 176—480.

Constructions

The following constructions may be required in translation from English into Latin in Paper I.

1. Common case usages, and the use of verbs governing the genitive, dative and ablative.
2. Prolate infinitive and infinitive as subject.
3. Use of participles.
4. Simpler uses of gerund and gerundive, including obligation.
5. Indirect statement.
6. Direct and indirect commands, excluding use of *neve*.
7. Direct and indirect questions, including double questions.
8. Purpose clauses excluding *qui* final, *quo* with comparative, and *neve*.
9. Result clauses excluding *qui* consecutive.
10. Relative clauses in direct speech.
11. Verbs of fearing.
12. Causal clauses, excluding *quod* and *quia* with subjunctive.
13. Concessive clauses using *quamquam* and *etsi* with indicative.
14. (a) *Cum* clauses meaning "when", "since", "although", but not "whenever": ("inverted *cum*" clauses are also excluded).
 (b) *Dum* clauses meaning "while" only.
 (c) Temporal clauses using *ubi*, *postquam*, *antequam*, *priusquam* with indicative.
15. Conditional clauses excluding those in *oratio obliqua*.

¹ Unless a special edition is prescribed, the text used by the examiners in selecting extracts for questions on prescribed books will be that of the Oxford Classical Texts with such modifications of spelling as may seem to them desirable.

(O 18) FRENCH (two papers [Paper I one and a quarter hours, Paper II one and three quarter hours] and an oral examination)

I. Translation of an English passage into French. Free composition **either** on the printed outline of an essay in French to be expanded by candidates **or** on a picture or series of pictures **or** on the continuation of the story narrated in the translation passage (each year two of the foregoing alternatives will be set).

II. Passages for translation from French into English. A passage in verse or prose to test comprehension (questions in English to be answered in English). An aural test in which a passage in French is read to the candidates who are subsequently required to answer questions on the passage; both questions and answers will be written and in English.

The oral examination will consist of dictation, the reading of a passage in French and the answering of questions in French.

(O 19) GERMAN (two papers [Paper I one and three quarter hours, Paper II one and a quarter hours] and an oral examination)

A candidate will be required to reach a satisfactory standard in Paper I before being awarded a pass in the subject.

I. One passage of continuous prose for translation from English into German. A reproduction test in which a passage in German is read to the candidates who are subsequently required to reproduce in German in continuous form the essential facts of the story with the aid of a printed outline.

II. Two passages for translation from German into English.

The oral examination will consist of dictation, the reading of a passage in German and the answering of questions in German.

(O 20) SPANISH¹ (two papers [Paper I one and a quarter hours, Paper II one and three quarter hours] and an oral examination)

A candidate will be required to reach a satisfactory standard in Paper I before being awarded a pass in the subject.

I. Translation from English into Spanish. Free composition **either** on the printed outline of an essay **or** on the continuation of the story narrated in one of the translation passages.

II. Translation from Spanish into English and a passage in verse or prose to test comprehension (questions in English to be answered in English). An aural test in which a passage in Spanish is read to the candidates who are subsequently required to answer questions on the passage; both questions and answers will be written and in English.

The oral examination will consist of dictation, the reading of a passage in Spanish and the answering of questions in Spanish.

(O 21) ITALIAN (two papers [Paper I one and a quarter hours, Paper II one and three quarter hours] and an oral examination)

I. Translation from English into Italian. Free composition **either** on the printed outline of an essay **or** on the continuation of the story narrated in one of the translation passages.

II. Translation from Italian into English and a passage in verse or prose to test comprehension (questions in English to be answered in English). An aural test in which a passage in Italian is read to the candidates who are subsequently required to answer questions on the passage; both questions and answers will be written and in English.

The oral examination will consist of dictation, the reading of a passage in Italian and the answering of questions in Italian.

¹ Candidates offering Spanish will be expected to conform to the system of accentuation set out by the Spanish Academy in *Nuevas normas de prosodia y ortografía* (1952, amended in 1959).

(O 22) RUSSIAN (O 23) WELSH (in each subject two papers each of one and a half hours and an oral examination)

In Russian a candidate will be required to reach a satisfactory standard in Paper I before being awarded a pass in the subject; in Welsh a satisfactory standard in each of Papers I and II will be required.

I. Translation from English into the language. Free composition **either** on the printed outline of an essay **or** on the continuation of the story narrated in one of the translation passages.

II. Translation from the language into English and a passage in verse or prose to test comprehension (questions in English to be answered in English).

The oral examination will consist of dictation, the reading of a passage in the language and the answering of questions in the language.

(O 24) OTHER APPROVED MODERN LANGUAGES

Application for other languages to be approved at the Ordinary level must be made at least one year before the examination. A fee of £5 is also payable in addition to the normal examination fee; this fee must be paid by 1 January preceding the examination.

USE OF STENCILS AND MATHEMATICAL TABLES IN MATHEMATICS AND SCIENCE SUBJECTS

Candidates are permitted to use stencils and mathematical tables in papers in Ordinary subjects 25 to 39 and 46, 47, 49. Mathematical tables will be supplied by the Board. Slide rules may not be used in any Ordinary paper.

(O 25) MATHEMATICS

Mathematics (O 25) may be offered at the same sitting of the examination as one, and only one, of the following mathematical subjects at Ordinary level: Pure Mathematics with Mechanics (O 26), Pure Mathematics with Statistics (O 28), Pure Mathematics (O 29). It may not be offered at the same sitting as Commercial Mathematics or any mathematical subject at Advanced level.

Two syllabuses are available. Candidates may offer **either** Syllabus A (pages 29 to 33) **or** Syllabus B (pages 33 and 34).

Either

SYLLABUS A (three papers: Arithmetic two hours, Algebra two hours, Geometry two and a half hours)

Each paper will consist of two sections. Section A will consist of straightforward questions all of which are to be attempted. In some of these questions the essential consideration will be that the answer should be correct; these questions will be indicated on the question paper. Explanations will not normally be expected in answers to these questions nor need candidates write down more of their working than they find convenient for their own purposes. The remaining questions in Section A will require full explanations and all necessary details of working. Section B will provide a choice of questions of greater length and difficulty; in all these questions full explanations and all necessary details of working will be required.

I. Arithmetic

(a) Numbers

The ordinary processes of Arithmetic. The commoner systems of weights, measures and money, including metric units. Fractions, decimals, ratio, proportion, percentage. Use of common logarithm and square-root tables. Significant figures.

[Questions may be set on the applications of these processes to problems of everyday life in the home and community including straightforward questions on financial transactions. Questions will not involve complicated operations or the knowledge of uncommon technical terms or the buying and selling of stocks and shares and will not require the "long rules" for the extraction of square roots and the determination of H.C.F.]

(b) Mensuration

The rectangle, triangle and figures derived from them, including easy extensions to three dimensions. The circle, cylinder, cone and sphere. (*Formulae for the cone and sphere need not be memorized.*)

(c) Trigonometry

Simple numerical trigonometry. The sine, cosine and tangent of an angle, acute or obtuse. The sine and cosine rules. Simple problems in two or three dimensions. (*There will be three questions on Trigonometry which will be alternative to certain of the Arithmetic questions.*)

[*The questions in the paper in Arithmetic will be mainly arithmetical in character but occasional questions involving the use of algebraic symbols and processes will not be excluded.*]

II. Algebra

Algebra to quadratic equations, including the solution of simultaneous equations, one quadratic and one linear; the use of logarithms to base 10 and the use of simple surds and indices; elementary treatment of ratio, proportion and variation; simple graphs, including the graphs of the functions $y = Ax^2 + Bx + C$ and $y = \frac{c}{ax + b}$ where the constants are numerical and where the range of values for accurate plotting will exclude $x = -b/a$.

III. Geometry

Candidates will be expected to answer questions both on Practical and on Theoretical Geometry.

The questions on *Practical Geometry* will be set on the constructions contained in the annexed Schedule 1, together with easy extensions of them. Where the validity of a construction is not obvious, the reasoning by which it is justified may be required. Every candidate must provide himself with a ruler graduated in inches and tenths of an inch and in centimetres and millimetres, a set-square, a protractor, compasses and a fairly hard pencil. All figures must be drawn accurately and distinctly. Questions may be set in which the use of the set-square or of the protractor is forbidden.

The questions on *Theoretical Geometry* will consist of theorems contained in the annexed Schedule 2, together with questions upon these theorems, easy deductions from them and arithmetical illustrations. Any proof of a proposition will be accepted which appears to the examiners to form part of a systematic treatment of the subject; the order in which the theorems are stated in Schedule 2 is not imposed as a sequence of their treatment. In the proof of theorems and deductions from them the use of hypothetical constructions will be permitted.

In writing out propositions and riders, references will be expected: these must be given in a form which is independent of the sequence adopted, e.g. "*ABC and ADC being angles in the same segment of a circle are equal*"; or, alternatively, "*∠ABC = ∠ADC (angles in the same segment)*". Reference to propositions by number, e.g. "*Prop. 32*", will not be accepted.

The use of algebraical symbols and (in the solution of riders) of trigonometrical ratios is permitted.

Practical Geometry: Schedule 1

Bisection of angles and of straight lines. Construction of perpendiculars to straight lines. Construction of an angle equal to a given angle. Construction of parallels to a given straight line. Simple cases of the construction from sufficient data of triangles and quadrilaterals. Division of straight lines into a given number of equal parts or into parts in any given proportions. Construction of a triangle equal in area to a given polygon. Construction of tangents to a circle and of common tangents to two circles. Construction of circumscribed, inscribed and escribed circles of a triangle. Construction of a segment of a circle containing a given angle. Simple cases of the construction of circles from sufficient data. Construction of a fourth proportional to three given straight lines and a mean proportional to two given straight lines. Construction of regular figures of 3, 4, 6 or 8 sides in or about a given circle. Construction of a square equal in area to a given polygon.

*Theoretical Geometry: Schedule 2*1. *Angles at a point*

(a) ¹If a straight line stands on another straight line, the sum of the two angles so formed is equal to two right angles; and ¹the converse theorem.

¹ The proof of this theorem will not be required.

(b) ¹If two straight lines intersect, the vertically opposite angles are equal.

2. Parallel straight lines

(a) ¹When a straight line cuts two other straight lines,

if (i) a pair of alternate angles are equal,

or (ii) a pair of corresponding angles are equal,

or (iii) a pair of interior angles on the same side of the cutting line are together equal to two right angles,

then the two straight lines are parallel; and ¹the converse theorem.

(b) ¹Straight lines which are parallel to the same straight line are parallel to one another.

3. Triangles and rectilinear figures

(a) The sum of the angles of a triangle is equal to two right angles.

(b) The sum of the interior angles of an n -sided polygon is equal to $(2n - 4)$ right angles.

(c) If the sides of a convex polygon are produced in order, the sum of the angles so formed is equal to four right angles.

(d) ¹If two triangles have two sides of the one equal to two sides of the other, each to each, and also the angles contained by those sides equal, the triangles are congruent.

(e) ¹If two triangles have two angles of the one equal to two angles of the other, each to each, and also one side of the one equal to the corresponding side of the other, the triangles are congruent.

(f) ¹If two triangles have the three sides of the one equal to the three sides of the other, each to each, the triangles are congruent.

(g) ¹If two right-angled triangles have their hypotenuses equal, and one side of the one equal to one side of the other, the triangles are congruent.

(h) ¹If two sides of a triangle are equal, the angles opposite to these sides are equal; and ¹the converse theorem.

(j) ¹If two sides of a triangle are unequal, the greater side has a greater angle opposite to it; and ¹the converse theorem.

(k) ¹Of all the straight lines that can be drawn to a given straight line from a given point outside it, the perpendicular is the shortest.

(l) If a parallelogram can be defined as a quadrilateral whose opposite sides are parallel, then in any parallelogram

(i) the opposite sides are equal,

(ii) the opposite angles are equal,

(iii) each diagonal bisects the parallelogram and the diagonals bisect each other.

(m) ¹A quadrilateral is a parallelogram if

(i) the opposite sides are equal,

or (ii) the opposite angles are equal,

or (iii) the diagonals bisect each other,

or (iv) one pair of opposite sides are both equal and parallel.

(n) If there are three or more parallel straight lines, and the intercepts made by them on any straight line that cuts them are equal, then the corresponding intercepts on any other straight line that cuts them are also equal.

4. Loci

(a) ¹The locus of a point which is equidistant from two fixed points is the perpendicular bisector of the straight line joining the two fixed points.

(b) ¹The locus of a point which is equidistant from two intersecting straight lines consists of the pair of straight lines which bisect the angles between the two given lines.

5. Areas

(a) Parallelograms on the same or equal bases and of the same altitude are equal in area.

(b) ¹Triangles on the same or equal bases and of the same altitude are equal in area.

¹ The proof of this theorem will not be required.

(c) ¹Equal triangles on the same or equal bases are of the same altitude.

(d) In a right-angled triangle the square described on the hypotenuse is equal to the sum of the squares described on the sides containing the right angle; and the converse theorem.

(e) Illustrations and explanations of the geometrical theorems corresponding to the following algebraical identities:

$$\begin{aligned} k(a+b+c+\dots) &= ka+kb+kc+\dots \\ (a+b)^2 &= a^2+2ab+b^2, \\ (a-b)^2 &= a^2-2ab+b^2, \\ a^2-b^2 &= (a+b)(a-b). \end{aligned}$$

(f) The square on a side of a triangle is greater or less than the sum of the squares on the other two sides, according as the angle contained by those sides is obtuse or acute. The difference is twice the rectangle contained by one of the two sides and the projection on it of the other.

(g) In any triangle, the sum of the squares on any two sides is equal to twice the square on half the third side, together with twice the square on the median which bisects the third side.

6. The circle

(a) A straight line drawn from the centre of a circle to bisect a chord which is not a diameter is at right angles to the chord; conversely, the perpendicular to a chord from the centre bisects the chord.

(b) ¹There is one circle, and one only, which passes through three given points not in a straight line.

(c) Equal chords of a circle are equidistant from the centre; and the converse theorem.

(d) ¹The tangent at any point of a circle and the radius through the point are perpendicular to one another; and ¹the converse theorem.

(e) If two circles touch, the point of contact lies on the straight line through the centres.

(f) The angle which an arc of a circle subtends at the centre is double that which it subtends at any point on the remaining part of the circumference.

(g) Angles in the same segment of a circle are equal; and, if the line joining two points subtends equal angles at two other points on the same side of it, the four points lie on a circle.

(h) The angle in a semicircle is a right angle; the angle in a segment greater than a semicircle is less than a right angle; and the angle in a segment less than a semicircle is greater than a right angle.

(j) The opposite angles of any quadrilateral inscribed in a circle are supplementary; and the converse theorem.

(k) In equal circles (or in the same circle) ¹if two arcs subtend equal angles at the centres, they are equal; and ¹the converse theorem.

(l) In equal circles (or in the same circle) ¹if two chords are equal, they cut off equal arcs; and ¹the converse theorem.

(m) If a straight line touches a circle, and from the point of contact a chord is drawn, the angles which this chord makes with the tangent are equal to the angles in the alternate segments; and ¹the converse theorem.

(n) If two chords of a circle intersect either inside or outside the circle the rectangle contained by the parts of the one is equal to the rectangle contained by the parts of the other; and ¹the converse theorem.

(o) ¹If, from a point outside a circle, a secant and a tangent are drawn, the rectangle contained by the whole secant and the part of it outside the circle is equal to the square on the tangent; and ¹the converse theorem.

7. Proportion: similar triangles

(Proofs which are only applicable to commensurable magnitudes will be accepted.)

(a) If a straight line is drawn parallel to one side of a triangle, the other two sides are divided proportionally; and the converse theorem.

(b) If two triangles are equiangular their corresponding sides are proportional; and the converse theorem.

¹ The proof of this theorem will not be required.

(c) If two triangles have one angle of the one equal to one angle of the other and the sides about these equal angles proportional, the triangles are similar.

(d) The internal bisector of an angle of a triangle divides the opposite side internally in the ratio of the sides containing the angle, and likewise the external bisector externally; and ¹the converse theorem.

(e) The ratio of the areas of similar triangles is equal to the ratio of the squares on corresponding sides.

Or

SYLLABUS B (two papers each of two and a half hours)

Each paper will consist of two sections: (1) straightforward questions, all of which are to be attempted; (2) questions of greater length and difficulty, a choice of questions being allowed. Each paper may contain questions on any part of the syllabus and the solution of any question may require knowledge of more than one branch of the syllabus. Unless the terms of the question impose specific limitations candidates may use any appropriate method of solution. Each candidate must provide himself with a ruler graduated in inches and tenths of an inch and in centimetres and millimetres, a set-square, a protractor, compasses and a fairly hard pencil.

1. Numbers

The ordinary processes of Arithmetic. The commoner systems of weights, measures and money, including metric units. Fractions, decimals, ratio, proportion, percentage. Use of common logarithm and square-root tables. Significant figures.

[Questions may be set on the applications of these processes to problems of everyday life in the home and community including straightforward questions on financial transactions. Questions will not involve complicated operations or the knowledge of uncommon technical terms or the buying and selling of stocks and shares and will not require the "long rules" for the extraction of square roots and the determination of H.C.F.]

2. Mensuration

The rectangle, triangle and figures derived from them, including easy extensions to three dimensions. The circle, cylinder, cone and sphere. (Formulae for the cone and sphere need not be memorized.)

[Questions may involve knowledge of the altitude and centre of an equilateral triangle and the ratio of the sides of the right-angled isosceles triangle and the 30°, 60°, 90° triangle.]

3. Formulae and equations

Construction of a formula through symbolical expression of a functional relation (e.g. V is proportional to x^2), or through generalization of an arithmetical result. Interpretation, evaluation and easy manipulation of a formula.

The use of indices. (Only simple examples of fractional and negative indices will be set. Questions involving manipulation of such indices or of surds will not be set but candidates may be expected to understand the use of indices to express such numbers as 3.74×10^8 or 1.35×10^{-6} .)

The use of a suffix notation. Common factors; factors of $(a^2 - b^2)$ and of such extensions as occur in mensuration. Easy factors of trinomials. Fractions whose denominators contain not more than two linear factors. (Simple manipulations will not include more than two such fractions.) Simple equations, quadratic equations and linear simultaneous equations in two variables.

4. Graphs, functionality

Graphs from statistical data. The idea of a function of a variable. Translation into symbols of relations such as " y is inversely proportional to x ", " V varies as x^2 ", and their illustration by sketch-graphs.

Simple cases of the function

$$y = Ax^3 + Bx^2 + Cx + D + \frac{E}{x} + \frac{F}{x^2}$$

where the constants are numerical, at least three of them being zero and only one of A , E and F appearing. Graphical treatment of these functions. (When E or F appears the range of values for accurate plotting will not include $x=0$.)

¹ The proof of this theorem will not be required.

The gradient of a graph, by drawing and by calculation. (*Questions will not involve theoretical treatment of limits.*) Application of gradients to (a) rates of increase, (b) easy linear kinematics including the distance-time and speed-time curves, (c) maxima and minima. The determination of a function from its gradient. The area "under" a graph by drawing and by calculation. Easy application to linear kinematics and volumes of revolution.

[*Questions on rates of change will not involve the use of the formula*

$$\frac{df(x)}{dt} = \frac{df(x)}{dx} \cdot \frac{dx}{dt}.$$

Questions may involve familiarity with the integral notion.]

5. Two-dimensional figures

A sound appreciation of the following properties will be expected but the reproduction of proofs of them will not be required. Questions will be set involving the use of these properties, but they themselves will not be set as riders. Candidates will be expected to understand the relation between a theorem and its converse.

Properties of angles at a point and angles made with parallel lines. The exterior angle property and angle-sum of a triangle. Angle-sum properties of polygons. Congruency of triangles; similarity of triangles. Symmetry about a point or line. The isosceles triangle; the parallelogram, rectangle, rhombus, square.

Parallelograms on the same base and between the same parallels are equal in area. The corresponding intercepts made by a set of parallel lines on two transversals are proportional. Other area properties of rectangles, parallelograms, triangles and trapezia, including the formula $\frac{1}{2}bc \sin A$. Connections between Algebra and Geometry, e.g. $(a+b)^2$, use of coordinates including negative coordinates. The sine, cosine and tangent of an angle, acute or obtuse. In any triangle $a/\sin A = b/\sin B = c/\sin C = 2R$, with numerical applications but not including the ambiguous case. The theorem of Pythagoras. $\sin^2 A + \cos^2 A = 1$. In any triangle $a^2 = b^2 + c^2 - 2bc \cos A$, with easy applications.

The symmetrical properties of chords of a circle. The angle properties of a circle. The perpendicularity of tangent and radius; the distance between centres of circles in contact; the equality of tangents from an external point. The "alternate segment" property. The property $OP \cdot OQ = OR \cdot OS$ for two intersecting chords or secants of a circle.

The relationship between the areas of similar figures and between the volumes of similar solids. The bisector of any angle of a triangle divides the opposite side in the ratio of the sides containing the angle; the analogous property for an exterior angle.

Knowledge of simple loci, with easy extensions to three dimensions. The method of intersecting loci. Geometrical construction of simple loci.

Knowledge of the following constructions by rulers and compasses will be assumed, set-squares being allowed for the construction of parallel lines:

Bisection of angles and straight lines. Construction of perpendiculars to a given line and of angles equal to a given angle. Construction of angles of 30° , 45° , 60° . Construction of triangles, quadrilaterals and circles from simple data, including the inscribed and circumscribed circles of a triangle. Division of a straight line into a given number of parts or in a given ratio. Construction of a triangle equal in area to a quadrilateral and of a square equal in area to a given rectangle. Construction of tangents from an external point. Construction of a segment containing a given angle.

6. Three-dimensional figures

The forms of the cube, rectangular block, pyramid, tetrahedron, prism, circular cylinder, circular cone and sphere; calculation of lengths and angles, including angle between two planes and angle between straight line and plane.

7. Practical applications

In addition to ordinary riders, questions involving drawing, trigonometry or geometrical reasoning may be set on the following:

Simple map problems, e.g. scales, contour lines, slopes. Determination of positions by two bearings (*bearings will be expressed in either of the two forms $N36^\circ E$ or $O36^\circ$*); the units nautical mile and knot may be used. Latitude and longitude; great and small circles on a sphere. The length of an arc in terms of the radius and the measure (in degrees) of the angle at the centre. Easy three-dimensional problems which can be solved by analysis into plane figures.

(O 26) PURE MATHEMATICS WITH MECHANICS (two papers: Paper I two and a half hours, Paper II two hours)

Pure Mathematics and Mechanics (O 26) may be offered with Mathematics (O 25): it may not be offered at the same sitting of the examination as Pure Mathematics with Statistics (O 28), Pure Mathematics (O 29), Commercial Mathematics (O 30) or any mathematical subject at Advanced level.

I. Pure Mathematics

Eight questions will be set of which the candidate will be required to answer seven.

Arithmetic and geometric progressions. The binomial theorem for a positive integral index. (The proof will not be required and questions will not be set on greatest terms and on sums of coefficients.) The idea of a function with special reference to the quadratic function and the other functions mentioned in Part II of (O 25) Syllabus A and in Section 4 of (O 25) Syllabus B. Symmetric functions of the roots of a quadratic equation.

Cartesian coordinates of a point, mid-point of a line joining two points, distance between two points. The straight line; $ax+by+c=0$, $y=mx+c$, $y-y_1=m(x-x_1)$; intersection of two lines, conditions for two lines to be parallel or perpendicular; equation of a line joining two points.

Trigonometrical ratios of angles of any magnitude; graphs of $\sin x$, $\cos x$ and $\tan x$ for all values of x . Formulae for $\sin(A \pm B)$, $\cos(A \pm B)$, $\tan(A \pm B)$, (proofs of these formulae will not be required); $\sin 2A$, $\cos 2A$, $\tan 2A$. Circular measure. Problems in three dimensions involving the angle between two planes and the angle between a straight line and a plane.

Gradients; the gradient at any point of $y=x^p$ (proof when p is not a positive integer will not be required); gradient of $y=f(x)$, where $f(x)$ is a sum of terms of the form ax^p . Integration as the inverse of differentiation. Applications of differentiation and integration to tangents, normals, maxima and minima, velocities, accelerations, areas and volumes.

II. Theoretical Mechanics

Seven questions will be set of which the candidate will be required to answer six.

The composition and resolution of velocities, accelerations and forces in one plane, referred to a single particle. Relative velocity. Moments of forces including parallel forces, referred to a particle and to a rigid body; centre of gravity. Graphical methods including the use of the triangle of forces and the polygon of forces but excluding frameworks.

Simple cases of equilibrium of a rigid body; friction.

Uniformly accelerated rectilinear motion; simple cases of motion of projectiles over a horizontal plane.

Newton's laws of motion; mass, weight, momentum, impulse, force, work, energy and power. Absolute and gravitational units.

Motion with uniform speed in a horizontal circle.

(O 28) PURE MATHEMATICS WITH STATISTICS (two papers: Paper I two and a half hours, Paper II two hours)

Pure Mathematics with Statistics (O 28) may be offered with Mathematics (O 25): it may not be offered at the same sitting of the examination as Pure Mathematics with Mechanics (O 26), Pure Mathematics (O 29), Commercial Mathematics (O 30) or any mathematical subject at Advanced level.

I. Pure Mathematics

Syllabus as for Pure Mathematics with Mechanics (O 26).

II. Statistics

Six questions will be set of which the candidate will be required to answer five.

The collection, classification, tabulation and diagrammatic representation of statistical data. Pictorial illustrations. Time series.

Frequency distributions. Histograms, frequency polygons, cumulative frequency diagrams. Percentiles and interpercentile ranges.

Measures of average (**or central tendency, or location**): arithmetic mean, geometric mean, median (determined graphically and from a set of discrete variates), mode (not to be calculated) and modal class.

Measures of dispersion: range, semi-interquartile range, mean deviation, standard deviation.

Calculation of arithmetic mean and standard deviation from a set of discrete variates and from a grouped frequency distribution. Mean and variance of a combination of two sets of observations.

Weighted averages (e.g. index numbers and weighted averages of percentage relatives, crude and standardized death rates).

Probability. Permutations and combinations. Combination of probabilities: mutually exclusive events, dependent and independent events. Expected value. The rectangular and binomial distributions.

The application of calculus to probability and to simple continuous probability distributions.

(O 29) PURE MATHEMATICS (two papers: Paper I two and a half hours, Paper II two hours)

Pure Mathematics (O 29) may be offered with Mathematics (O 25): it may not be offered at the same sitting as Pure Mathematics with Mechanics (O 26), Pure Mathematics with Statistics (O 28), Commercial Mathematics (O 30) or any mathematical subject at Advanced level.

I. Pure Mathematics

Syllabus as for Pure Mathematics with Mechanics (O 26).

II. Pure Mathematics

Seven questions will be set of which the candidate will be required to answer six.

Simple applications of permutations and combinations. Theory of logarithms. Mathematical induction. Simple finite series.

The function $a \cos x + b \sin x$. The sum and product transformations i.e. $\sin A \pm \sin B$ etc.

The application of the methods of coordinate geometry to simple loci. (Knowledge of properties of curves will not be assumed.) Angle between two lines. Equation of a circle; tangent to a circle.

Simple applications of the formula

$$\frac{df(x)}{dt} = \frac{df(x)}{dx} \cdot \frac{dx}{dt}$$

Applications to rates of change. Differentiation of products and quotients. Differential coefficient of $\sin x$, $\cos x$ and $\tan x$. The integrals of $\sin x$ and $\cos x$.

(O 30) COMMERCIAL MATHEMATICS (three papers: Paper I, Section A twenty minutes, Section B two hours; Paper II two hours; Paper III two and a half hours)

Commercial Mathematics may not be offered at the same sitting of the examination as any of the following: Mathematics (O 25), Pure Mathematics with Mechanics (O 26), Mathematics (A 26), Further Mathematics (A 27), Pure Mathematics with Statistics (O 28 and A 28), Pure Mathematics (O 29 and A 29).

I. Commercial Arithmetic

Section A

Two long additions of £. s. d. together with eleven other questions on simple arithmetical rules.

Section B

(To follow immediately after Section A.)

Part I. Straightforward questions, all of which are to be attempted.

Part II. More difficult questions, three of which are to be attempted.

1. The ordinary processes of Arithmetic. Weights and measures, metric system, money. Fractions, ratio, proportion, averages, decimals. Significant figures, contracted methods. Use of logarithms and square-root tables.

2. Percentages. Trade and cash discounts. Simple interest. True discount. Banker's discount. Commission. Mean and due date. Gross and net profits. Partnership; division of profits. Investments in stock exchange securities. Par of exchange. Calculation of prices from given data—freight, insurance, rates of exchange, terms of payments, etc.

3. Compound interest law and its application; present and future values; leasehold redemption; depreciation (e.g. of machinery); rates of increase (e.g. of population).

4. Graphs; comparison of growths and depreciation under simple and compound interest laws, using natural and logarithmic scales.

II. *Algebra, Mensuration and Trigonometry*

Section A. Straightforward questions, all of which are to be attempted.

Section B. More difficult questions, three of which are to be attempted.

Algebra

Use of symbols. The fundamental processes of Algebra.

Interpretation and use of formulae. Changing the subject of a formula.

Factors of expressions of simple types—common factors, difference of squares, trinomials.

Equations of first and second degree in one unknown. Simultaneous equations of first degree in two and three unknowns.

Graphs of linear and quadratic functions.

Applications of the above to the solution of problems.

Mensuration

Mensuration of the rectangle, parallelogram, triangle, trapezium and circle.

The theorem of Pythagoras as a method of calculation of the length of a side of a right-angled triangle.

The 30° , 60° , 90° triangle and the 45° , 45° , 90° triangle.

Mensuration of the prism, pyramid, cylinder, cone and sphere. (Formulae for the last two need not be memorized.)

Similar figures, weight and density.

Trigonometry

The trigonometrical ratios for acute angles only. Use of tables. Ratios for angles of 30° , 45° and 60° .

Solution of right-angled triangles and isosceles triangles.

Solution of problems in two dimensions involving right-angled triangles.

III. *Statistics*

Section A. Theoretical questions, two of which are to be attempted.

Section B. Practical questions, four of which are to be attempted.

The value of statistics in commerce. The collection of statistical data; their adequacy and reliability.

Approximation and accuracy.

Presentation of data: simple classification and tabulation.

The frequency distribution. Secondary statistics. Pictorial representation: bar diagrams, block diagrams, circular diagrams, histograms, frequency diagrams, cumulative frequency diagrams.

Graphs of statistical data: time series. Use of ratio scales.

Analysis of data. Measures of average. Calculation of arithmetic mean for a set of values and for a frequency distribution. The median (determined graphically and by a selection from a set of discrete values). The mode (not to be calculated). Measures of dispersion. Simple calculations of mean deviation and standard deviation. Range, quartiles, percentiles, semi-interquartile range (quartiles and percentiles determined graphically).

OPTIONAL PRACTICAL EXAMINATIONS

Heads of schools may submit candidates for an Optional Practical Examination in Physics, Chemistry and Biology at the Ordinary level. Candidates who reach the required standard will have this recorded on the General Certificate of Education, provided that they also reach the required standard in the written paper. The examinations are held during the period April—June at a fee of £5 a day for each examiner employed.

Application for Optional Practical Examinations must be made on the preliminary entry-form before 1 January of the year of the examination. Schedules indicating the requirements of these examinations may be obtained from the Secretary and should be consulted before an application is submitted.

(O 31) PHYSICS (one paper of two and a half hours)

Physics may not be offered at the same sitting of the examination as either Physics-with-Chemistry or General Science I or II.

The paper will be divided into two sections, (A) easy questions of a routine type, (B) questions of greater length and difficulty.

Section A will consist of sixteen questions, candidates being required to answer any twelve. Section B will be divided into three sub-sections. Sub-section I will consist of four questions on Mechanics and Sound, Sub-section II of four questions on Heat and Light and Sub-section III of five questions on Magnetism and Electricity. Candidates will be required to answer five questions from Section B, at least one being chosen from each of the three sub-sections.

Problems involving simple graphical representation of related physical quantities may be set. Numerical problems may be solved where appropriate either by calculation or by graphical methods. Numerical examples on current electricity will involve the practical system of units only. In setting the questions regard will be paid to the conditions under which the subject may best be studied experimentally in schools.

(a) Mechanics and Sound

1. Rectilinear motion: velocity and linear acceleration; uniform acceleration, distance-time and velocity-time graphs and simple related problems. Newton's laws of motion: the relation between force, mass, momentum and acceleration; absolute and gravitational units. The determination of g by a simple method. Vector and scalar quantities; parallelogram (triangle) of displacements, velocities and forces. The resolution of a force into components at right angles. Moments. Centre of gravity and its experimental determination for a lamina.

2. Work, energy and power; the conservation of energy; simple problems involving the units erg, joule, watt, foot-pound weight and horse-power. Levers, the inclined plane, the block and tackle; mechanical advantage, velocity ratio and efficiency of these machines. Qualitative ideas on friction, brake horse-power. Hooke's law and its simple limitations as illustrated by the extension of a spiral spring and of a wire.

3. Density; relative density (specific gravity); principle of Archimedes and flotation; the common hydrometer. Pressure in fluids, Boyle's law; barometers (excluding Fortin pattern); lift pump, force pump. Simple forms of air pump (compression and exhaust).

4. Elementary treatment of wave motion: the relation between velocity, frequency and wavelength. The production and propagation of sound. The physical factors which determine the loudness, pitch and quality of sounds. Experimental determination of the velocity of sound in air by a simple method. Reflection of sound, echoes. Determination of the frequency of a tuning fork by any one method. Factors which affect the frequency of the note from a vibrating string and from a vibrating air column. End correction. Resonance.

(b) Heat and Light

1. Temperature; the liquid-in-glass thermometer, maximum and minimum thermometers, Centigrade (Celsius) and Fahrenheit temperature scales and their conversion, determination of fixed points.

2. Elementary calorimetry, determination of the specific heat of solids and liquids (excluding the method of cooling). Meaning of calorific values of fuels and foodstuffs. Expansion of solids, liquids and gases. Coefficient of linear expansion and its determination; measurement of coefficient of apparent expansion of a liquid (the distinction between real and apparent expansion is required but questions will not be set on the method of balancing columns). The relation between pressure, volume and temperature of a gas, treated quantitatively. The idea of the absolute zero of temperature.

3. Change of state: volume changes which accompany it. Latent heats of fusion and evaporation. Vapours and vapour pressure. Effects of pressure and dissolved substances on the boiling points of liquids and on the melting point of ice. Cooling by evaporation; simple refrigerator circuit of the volatile liquid type. Moisture in the atmosphere, relative humidity (treated qualitatively), dew point; a study of the Regnault type hygrometer; the wet and dry bulb hygrometer.

4. The processes of conduction and convection; examples of their practical application. Approximate comparison of thermal conductivities. Radiant energy; the relative emission and absorption of such radiation by different surfaces.

5. The mechanical equivalent of heat and its experimental determination by a simple mechanical method. Heat as a form of energy. Simple treatment of steam engines, steam turbines and internal combustion engines.

6. Propagation of light in straight lines, shadows. Eclipses of sun and moon. Pin-hole camera.

7. Reflection from plane surfaces; laws of reflection; construction of path of reflected ray; rotation of plane mirror. Reflection by concave and convex spherical mirrors; principal focus and focal length; formation of real and virtual images; determination of the focal length of a concave mirror; magnification.

8. Refraction; laws of refraction; refractive index and its determination by simple methods (critical angle methods not expected); real and apparent depth; total internal reflection, critical angle, use of right angle prism. Refraction by a prism, deviation. Thin converging and diverging lenses; principal foci and focal length; formation of real and virtual images; magnification; determination of focal length of converging lens by conjugate points and by use of plane mirror. The eye as a simple optical instrument; long and short sight and their correction by means of spectacles (numerical questions will not be set). Simple camera, magnifying glass, projection lantern. The elements of the structures of the compound microscope and refracting telescopes, excluding numerical calculations and ray diagrams. (Numerical examples on both mirrors and lenses may be solved either by the graphical method or by use of the formula involving u , v and f using any consistent sign convention.)

9. Dispersion; simple experiments on the analysis and the recombination of white light. Formation of a pure spectrum (spectrometer not expected). Colour: primary, secondary and complementary colours; addition and subtraction of coloured lights and pigments, treated simply. Descriptive study of the electro-magnetic spectrum including radio-frequency, infra-red and ultra-violet radiations, X-rays and gamma rays.

(c) *Magnetism and Electricity*

1. Simple phenomena of magnetism, experiments on magnetic induction; methods of magnetization and demagnetization; laws of magnetic force, unit pole, magnetic field strength; representation of magnetic fields by lines of force, fundamental ideas of the earth's magnetic field (dip circle not required).

2. Simple phenomena of electrostatics; electrification by friction, positive and negative charges, conduction, induction, gold leaf electroscope, distribution of charge, discharging action of points. Electrophorus.

3. The electric current: demonstration of its existence by its chemical, magnetic and thermal effects. The relation between an electric current and the flow of electrons. The simple voltaic cell and its defects; Daniell cell, Leclanché cell, dry cell; lead accumulator and its maintenance. (The nature of the electrodes when charged and discharged should be known, but details of the chemical processes involved are not required.)

4. The magnetic field due to a current, galvanometers for detecting currents, force on a current-carrying conductor in a magnetic field (treated qualitatively), the moving-coil galvanometer, ammeter, the simple motor.

5. Faraday's laws of electrolysis with simple numerical examples and practical applications.

6. Ohm's law (questions will not be set on the experimental verification); potential difference, resistance, electromotive force and terminal voltage; voltmeters; comparison of resistances by metre bridge; resistivity; shunts. Comparison of e.m.f.'s with potentiometer.

7. Heating effects of current; kilowatt-hour (Board of Trade Unit); consumption of energy in D.C. circuits.

8. Experiments to illustrate the fundamental phenomena of electro-magnetic induction; the laws of electro-magnetic induction. Simple forms of A.C. and D.C. generators. Simple transformers; the induction coil.

9. Simple demonstration of the magnetic, heating and chemical effects of A.C. One type of A.C. ammeter.

10. The electron; thermionic emission and the diode valve as a rectifier. Simple ideas of atomic structure.

(O 32) CHEMISTRY (one paper of two and a half hours)

Chemistry may not be offered at the same sitting of the examination as either Physics-with-Chemistry or General Science I or II.

The paper will be divided into two sections. Section (A) will consist of questions of a factual or numerical type, capable of short answers, all of which the candidate will be required to attempt. Section (B) will consist of questions of greater length of which the candidate will be required to attempt five.

Throughout all descriptive work physical appearance, e.g. colour change, should be especially emphasized. Where a gas is named a knowledge of its preparation and properties will be assumed.

1. Classification of substances as (a) solid, liquid or gas, (b) element, compound or mixture.

2. Solubility and solution; qualitative differences between solutions and pure solvents (the quantitative variation of solubility with temperature is *not* required). Water of crystallization. Hydrates.

3. Criteria of chemical change which distinguish it from physical change.

4. The chief types of chemical change treated descriptively and qualitatively: synthesis, combustion, oxidation, reduction, acid-base reactions including neutralization, double decomposition, replacement, reversible reactions incorporating the idea of chemical equilibrium, dissociation including thermal dissociation and electrolytic dissociation, thermal decomposition, catalysis, exothermic and endothermic reactions. (*The examiners will use the sign convention which represents as positive the heat (Q) given up by the chemical system to the surroundings in an exothermic reaction.*)

5. The laws of chemical combination: (a) conservation of mass, (b) definite proportions, (c) multiple proportions, (d) Gay Lussac's law of combining volumes.

6. The properties of gases: the concept of molecules in motion in gases, diffusion of gases treated qualitatively, pressure resulting from the impact of molecules. Calculations involving the general gas law; the convention of N.T.P. (S.T.P.).

7. Vapour density. Avogadro's hypothesis. Relation between vapour density and molecular weight; the atomicity of gaseous elements. Gram-molecular weight (G.M.W.) and gram-molecular volume (G.M.V.). The idea of equivalents and gram-equivalents of elements related by definition to (a) oxygen as the primary standard and (b) hydrogen as a secondary derived standard. The equivalents of the common acids and alkalis. Relation between equivalent weight, atomic weight and valency.

8. The use of symbols and formulae for atoms, ions and molecules. Quantitative interpretation of chemical equations; calculations of volumes of evolved gases.

9. Simple chemical experiments related to the foregoing paragraphs, involving weight and volume measurements; simple calculations based thereon, including volumetric measurements of acid-base and acid-carbonate reactions.

10. Characteristic contrasting properties of (a) metals, (b) non-metals. The order of chemical reactivity of metals and their ions in aqueous solution (e.g. the electro-chemical series). The general properties of acids, bases, salts and oxides, including basicity, acid salts and basic salts. General methods of preparing salts: (a) direct combination, (b) metal-acid reactions, (c) acid-base reactions including neutralization, (d) precipitation, (e) acid-carbonate reactions.

11. Simple ionic theory as illustrated in neutralization, electrolytic conduction and the formation of precipitates. Ion formation by gain or loss of one or two electrons as illustrated by the hydrogen, sodium, calcium and chloride ions.

Questions on electrolysis will be limited to the following:

- (a) the classical experiments, namely the electrolysis of acidified water, brine and hydrochloric acid in simple voltmeters; Davy's isolation of sodium;
- (b) the Faraday laws; simple voltmeters in series;
- (c) fused sodium chloride with iron cathode and carbon anode;
- (d) copper sulphate solution with platinum electrodes;
- (e) copper sulphate solution with copper electrodes;
- (f) sodium hydroxide solution with platinum electrodes;
- (g) sodium chloride solution in diaphragm cells;
- (h) the manufacture of aluminium (see §21 below).

12. *Hydrogen*

- (a) Preparation from (i) acids, (ii) alkalis, (iii) water.
- (b) Commercial preparation by (i) electrolysis and (ii) water gas.

13. *Oxygen*

Preparation by the usual laboratory methods. The properties of oxygen including its reaction with magnesium and with phosphorus. Commercial preparation by the distillation of liquid air. General methods of preparing oxides and hydroxides. Types of oxides, i.e. acidic, basic, amphoteric and neutral oxides and peroxides. Hydrogen peroxide.

14. *Air and water*

Air and its composition. The gravimetric and volumetric composition of water. Reaction of water with metals.

15. *Nitrogen*

Preparation (a) in the laboratory, (b) on a large scale. Ammonia and ammonium salts. The reactions of ammonia in solution with the salts of the metals specified below. Nitric oxide. Nitrogen dioxide (dinitrogen tetroxide). Nitric acid and nitrates. (Nitrites are excluded.) The Haber process qualitatively described. The commercial oxidation of ammonia to nitric acid.

16. *Carbon*

Allotropic forms of carbon: diamond, graphite and amorphous carbon. Combustion and respiration. Carbon dioxide; carbonates and bicarbonates. Carbon monoxide. Water gas. Producer gas. Coal gas.

17. *Sulphur*

Allotropic forms of sulphur: rhombic, monoclinic and plastic; their preparation and properties. Hydrogen sulphide including its reactions in solution with the salts of the metals specified below. Sulphur dioxide, sulphurous acid and the sulphites. Sulphur trioxide, sulphuric acid and the sulphates. The manufacture of sulphuric acid by the chamber and contact processes, including the production from anhydrite.

18. *Chlorine*

Preparation (a) in the laboratory, (b) commercially. The properties of chlorine, including its reaction with phosphorus and with potassium iodide. Chlorine as a member of the halogen family with reference to bromine and iodine; the simple relationships of these elements (the preparation of bromine and iodine and of their compounds is excluded). Hydrogen chloride, hydrochloric acid and the metallic chlorides. The action of chlorine on sodium hydroxide.

19. *Sodium*

The manufacture of the metal (see §11 (c) above). Sodium hydroxide; its manufacture (see §11 (g) above) and properties, including its reactions with salts of the metals specified below. Sodium salts of the acids specified above. The uses of sodium compounds including (a) the ammonia-soda process, (b) the electrolysis of brine to produce (i) sodium hydroxide, (ii) hydrogen, (iii) chlorine, (iv) hydrogen chloride and hydrochloric acid, (v) sodium hypochlorite.

20. *Calcium*

Naturally occurring compounds of importance: limestone, marble, chalk, gypsum, anhydrite. Calcium salts of the acids specified above. Hardness of water and its removal. Calcium oxide and hydroxide; mortar, cement and plaster of Paris.

21. *Aluminium*

The manufacture of the metal from purified alumina. Aluminium oxide and hydroxide. The thermit reaction. Aluminium sulphate and aluminium chloride.

22. *Copper*

The electrolytic purification of the metal, excluding all other metallurgical processes (see §11 (e) above). Cupric oxide. Cupric salts of the acids specified above.

23. *Iron*

Common ores. An elementary study of the production of pig iron by the blast furnace process. The oxides of iron. Ferrous and ferric sulphates and chlorides. Ferrous sulphide and iron pyrites.

24. *Lead*

The production of the metal in the laboratory from lead monoxide. Lead salts of the acids specified above. Lead monoxide, red lead and lead dioxide.

25. *Zinc*

The commercial production of the metal. Zinc oxide. Zinc salts of the acids specified above.

(O 33) PHYSICS-WITH-CHEMISTRY (two papers: Physics one and a half hours, Chemistry one and a half hours).

Physics-with-Chemistry may not be offered at the same sitting of the examination as either Physics or Chemistry or General Science I or II (Ordinary or Advanced).

Numerical problems may be solved where appropriate either by calculation or by graphical methods.

In setting the questions regard will be paid to the conditions under which the subject may best be studied experimentally and in relation to everyday life.

In order to pass in the subject a candidate must satisfy the examiners in each paper separately.

I. PHYSICS

(a) *Mechanics, Sound*

1. Simple graphical representation of related physical quantities.

2. Practical methods of measurement of weight and volume. Density and relative density (specific gravity), principle of Archimedes and its applications; flotation and the common hydrometer. Pressure in liquids at rest, balancing liquids in a U tube.

Pressure of gases, atmospheric pressure, the mercury barometer (excluding Fortin pattern); Boyle's law with the experimental proof and calculations; measurement of pressure, e.g. gas supply, football bladder.

Simple air pump, syringe, lift pump, force pump.

3. Simple calculations on uniformly accelerated rectilinear motion including problems on falling bodies. Newton's laws of motion. The experimental treatment of the relation between force, mass and acceleration, with simple problems.

Use of the spring balance to measure weight; force; parallelogram and triangle of forces, resolution of a force into components at right angles, simple examples of three forces in equilibrium; simple experiments and calculations on moments; applications of the principle of moments; centre of gravity including experimental determination for a lamina.

4. Work, energy and power; conservation of energy; simple problems involving the units erg, joule, watt, foot-pound weight and horse-power.

5. Simple machines: levers, the common balance, the inclined plane, the single pulley, the block and tackle, the wheel and axle. Mechanical advantage, velocity ratio and efficiency.

6. The production and transmission of sound; experimental determination of the velocity of sound in air; experiments on the vibration of strings.

(b) *Heat, Light*

1. Temperature, the liquid-in-glass thermometer, temperature scales and their conversion, determination of fixed points, clinical thermometer.

Expansion of solids, liquids and gases; coefficients of linear expansion; relation between pressure, volume and temperature of a gas treated quantitatively. Calorimetry applied to the determination of the specific heat of solids and liquids (excluding determination by the method of cooling).

2. Change of state; determination of melting and boiling points, simple experimental treatment of the effect of pressure on boiling point; latent heats of fusion and evaporation. Descriptive treatment of the transmission of heat by conduction, convection and radiation. The relation between heat and mechanical energy.

3. Propagation of light in straight lines; images and shadows, eclipses of sun and moon, pin-hole camera.

4. Reflection from plane surfaces, laws of reflection, construction of path of the reflected beam, lateral inversion of image; reflection from concave and convex spherical mirrors, principal focus and focal length of a spherical mirror, formation of real and virtual images, geometrical construction of images, magnification.

5. Refraction, laws of refraction, geometrical construction of path of a refracted ray, real and apparent depth of liquids and thickness of glass, total reflection and use of the right-angled prism, convex and concave lenses, principal focus and focal length, formation of real and virtual images, magnification, geometrical construction of images; one-lens camera, projection lantern, the normal eye as a simple optical instrument. (Numerical examples of both mirrors and lenses may be solved either by graphical methods or by the use of the formulae involving u , v and f with any consistent sign convention.)

6. Elementary treatment of colour, use of the prism to produce a spectrum.

(c) *Magnetism, Electricity*

1. Simple phenomena of magnetism, experiments on magnetic induction; methods of magnetization; experimental study of lines of force. Permanent and temporary magnets; the earth as a magnet, variation (declination), dip (inclination)—dip circle not required.

2. The simple cell, Leclanché cell (wet and dry types). Elementary conceptions of voltage, current and resistance; volt, ampere, coulomb, ohm, watt and kilowatt-hour. Arrangement of cells in series and parallel.

3. Magnetic effects of the current: field of force due to the current, electro-magnets and the electric bell, simple forms of ammeter and voltmeter, simple form of electromotor.

4. Chemical effects of the current: electrolysis, determination of the electro-chemical equivalent of a metal, electroplating.

5. Thermal effect of the current; laws and experimental illustrations, simple form of hot-wire ammeter.

6. Ohm's law, resistances in series and parallel, shunts and their uses, conversion of ammeter to voltmeter, determination of the resistance of a wire by means of an ammeter and voltmeter, specific resistance. Simple experiments on electro-magnetic induction, simple form of generator, simple transformer, induction coil, telephone and microphone.

II. CHEMISTRY. (A knowledge of industrial processes is not required.)

Where a gas is named in the syllabus a knowledge of its preparation in the laboratory and its properties will be assumed.

1. Classification of substances as (a) solid, liquid or gas, (b) element, compound or mixture.
2. General laboratory methods including solution, crystallization, distillation, precipitation and their use in the preparation of pure substances.
3. Criteria of chemical change which distinguish it from physical change.
The chief types of chemical change: combustion, oxidation, reduction, acid-base reactions including neutralization, double decomposition, replacement, dissociation including thermal dissociation and electrolytic dissociation, thermal decomposition. Exothermic and endothermic reactions. (All treated qualitatively and descriptively only.) Electrolysis.
4. The laws of chemical combination: conservation of mass, laws of (a) definite and (b) multiple proportions, Gay Lussac's law of combining volumes.
5. Calculations involving the general gas law; the convention of N.T.P.(S.T.P.).
6. Vapour density. Avogadro's hypothesis. Relation between vapour density and molecular weight. Gram-molecular weight (G.M.W.) and gram-molecular volume (G.M.V.). The idea of equivalents and gram-equivalent of elements related by definition to (a) hydrogen, (b) oxygen.
7. Relation between equivalent weight, atomic weight and valency. Faraday's laws of electrolysis.
8. The use of symbols for atoms of elements, and of formulae for molecules. Interpretation of chemical equations qualitatively and quantitatively; calculations of volumes of evolved gases.
9. Simple chemical experiments related to the foregoing paragraphs, involving weight and volume measurements; simple calculations based thereon.
10. Characteristic contrasting properties of (a) metals, (b) non-metals. The properties and uses of the metals magnesium, copper, zinc, aluminium, tin, lead and iron including their commonest alloys. The general properties of acids, bases, salts and oxides, including basicity, acid salts and basic salts. General method of preparing salts: (a) acid-base reactions including neutralization, (b) metal-acid reactions, (c) acid-carbonate reactions, (d) direct combination, (e) precipitation.
11. Laboratory preparation of hydrogen from (i) acids, (ii) water.
12. Oxygen. General methods for preparing oxides and hydroxides. Types of oxides, i.e. acidic, basic and neutral.
13. Air and its composition as historically demonstrated and quantitatively measured. Water; its composition; hardness of water. Water vapour and carbon dioxide in the atmosphere.
14. Nitrogen. Ammonia and ammonium salts. Nitric acid and nitrates. Nitrous oxide, nitric oxide, nitrogen dioxide.
15. Carbon (diamond and graphite). Carbon dioxide, carbonic acid, carbonates and bicarbonates; carbon monoxide; the elementary principles of destructive distillation of coal, coal gas.
16. Sulphur; hydrogen sulphide and other sulphides. Sulphur dioxide; sulphuric acid (excluding its preparation) and sulphates. (The allotropy of sulphur is not included.)
17. Chlorine. Hydrogen chloride. Hydrochloric acid and chlorides.

18. An elementary study of the following: sodium hydroxide, sodium carbonate, sodium bicarbonate, chalk, lime, copper (cupric) oxide, copper sulphate, litharge, red lead, lead dioxide.

(O 36) BIOLOGY (one paper of two and a half hours)

Biology may not be offered at the same sitting of the examination as either Botany or Zoology or General Science I or II or Human Biology (Ordinary or Advanced).

Candidates will be expected to possess a knowledge of those portions of elementary Chemistry and Physics which are necessary for the proper understanding of the subject-matter of the syllabus, and to show by their answers that their knowledge of the subject has been based upon the observation and study of living plants and animals and upon simple preparations and experiments.

In general a knowledge of microscopic structure is not required.

Specimens will be supplied for observation and description; the specimens supplied will not necessarily be confined to those named in the syllabus. Each candidate must bring to the examination a hand-lens, a knife and a pair of mounted needles.

1. The structure of a green flowering plant as a basis for the understanding of the elementary principles of its physiology.

(a) Nutrition (absorption, photosynthesis, assimilation and translocation); storage organs and material.

(b) Absorption, transport and loss of water.

(c) Respiration.

(d) Reproduction, asexual and sexual; dispersal of fruits and seeds.

(e) Structure and germination of the broad bean and sunflower.

(f) Growth. Geotropism, phototropism, hydrotropism.

2. Floral morphology as shown by a buttercup, a zygomorphic flower (a legume) and a composite.

3. Woody and herbaceous growth; deciduous and non-deciduous trees.

4. The structure of a mammal in such detail only as will explain the elementary principles of its physiology.

(a) Skeleton and muscles in relation to movement.

(b) Food constituents, food tests, feeding, digestion, absorption and assimilation.

(c) Breathing and respiration.

(d) The circulation and functions of the blood.

(e) Excretion.

(f) Awareness of changes in surroundings (receptors, with special attention to the eye and ear). Response to these changes (effectors). The integration of reception and response by the nervous system.

(g) Reproduction, without details of placental structure.

5. (a) A comparison of the habits of life and of the life histories (embryonic structure not required) of a fish, a frog, a bird and a mammal.

(b) The range of animal life as further exemplified by an elementary study of Amoeba, Hydra, earthworm and such insects as a cockroach and a butterfly or moth. The general features of growth and metamorphosis in the types underlined.

(c) A survey of the range of plant life, including life histories, as exemplified by an elementary study of Euglena, Spirogyra, Mucor, a bryophyte, a fern (details of structures are not required in a bryophyte and in a fern).

6. (a) The general characteristics and energy relations of living organisms; the differences between plants and animals.

(b) The relation of plants and animals to their natural environments; interdependence of plant and animal life.

(c) The structure and properties of soil. Carbon and nitrogen cycles.

(d) Symbiosis and parasitism.

(O 37) GEOLOGY (one paper of two and a half hours and a practical examination)

A candidate will be required to satisfy the examiners in the written paper before being awarded a pass in the subject.

1. The earth, its form and major surface features—continents and oceans.
2. The materials of the earth's crust—rocks and minerals.
 - (a) The composition and physical characters of quartz, feldspars, mica, hornblende, augite, hematite, magnetite, pyrites, galena, calcite, fluorspar, rock-salt, gypsum, barytes.
 - (b) The general character and modes of formation of conglomerate, sandstone, shale, mudstone, limestone (including chalk), coal; granite, gabbro, quartz porphyry, dolerite, rhyolite, basalt; slate, quartzite, marble, schist, gneiss.
 - (c) The origin and accumulation of oil.
3. Denudation and deposition. An outline of the work of atmospheric agencies, underground and surface waters, ice, the sea and resulting land forms. Lakes.
4. Earth movements. Earthquakes (excluding their bearing on the internal structure of the earth); evidence of recent changes of level, e.g. raised beaches and submerged forests; simple structures in the earth's crust: folds, faults, unconformities, inliers and outliers.
5. Igneous activity. The main types of volcano, their products and general distribution. The main types of igneous intrusion and the associated rock types. Metamorphic aureole.
6. The nature and uses of fossils: corals, graptolites, brachiopods, lamellibranchs (pelecypods), ammonoids, echinoids, trilobites.
7. An outline of the geological history of the British Isles: Pre-Cambrian, Lower Palaeozoic, Upper Palaeozoic, Mesozoic, Tertiary and Quaternary.
8. The geology of any district studied in the field.

Practical Examination (two and a half hours)

1. The interpretation of simple geological structures represented on maps: horizontal and inclined strata, simple folds (non-plunging), faults (normal and reversed), igneous intrusions, unconformities. The drawing of sections.
2. Characteristic features and identification of hand specimens of the rocks and minerals in §2 above.
3. Characteristic features and geological age of the fossil groups in §6 above.
4. Recognition of simple geological features on photographs.
(The use of a hand-lens is permitted in the Practical Examination.)

The practical examination will be held at centres to be determined by the Board.

(O 38) GENERAL SCIENCE I (O 39) GENERAL SCIENCE II (in each subject one paper of two and a half hours)

General Science I and/or II may not be offered at the same sitting of the examination as either Physics or Chemistry or Physics-with-Chemistry or Botany or Zoology or Biology (Ordinary or Advanced).

Either General Science I or General Science II or both subjects may be offered.

It is expected that the scientific principles mentioned in this syllabus will be studied in relation to their practical applications in everyday life and that where possible living organisms will be observed in their natural habitat.

Candidates will be expected to have performed, or be familiar with, laboratory experiments illustrative of the subject matter of the syllabus; quantitative measurements and laboratory preparations will only be expected where specifically indicated.

Numerical questions will be set only on those topics which are underlined except where full information can be given in the question.

The parts of the syllabus printed in italics will not be examined in General Science I.

1. Density; Archimedes' principle; flotation and buoyancy. Fluid pressure and its relation to total thrust; simple barometers; pumps; the siphon; Boyle's law. Measurement of density by the displacement method and by the use of Archimedes' principle. Measurement of fluid

pressure. *Simple qualitative treatment of surface tension, diffusion, osmosis, change of state and gas pressure from the standpoint of the molecular theory.*

2. Experimental treatment of force; weight, tension, thrust; moments, levers. Centre of gravity.

Work and its measurement in ft. lb. wt.; potential energy. Kinetic energy and conservation of mechanical energy in the absence of friction. *Qualitative treatment of friction and common methods of reducing it.* Measurement of force with a spring balance.

Mechanical advantage, velocity ratio and efficiency of simple machines as illustrated by block and tackle, wheel and axle, differential pulley, gear wheel and simple screw.

Power: horse-power; relation of watt to horse-power.

Composition and resolution of inclined velocities and forces.

Newton's first law; inertia; mass; dependence of acceleration on force and mass; simple explanation of centripetal acceleration and force, with applications. Dependence of kinetic energy on mass and velocity. Simple pendulum.

3. Heat and temperature.

Thermal expansion; *the meaning and use of the coefficient of linear expansion of solids and of the coefficient of volume expansion of liquids and gases;* the change of volume of water on freezing and on heating; thermometry, temperature scales, thermostats.

Charles's law; absolute temperature.

Conduction, convection, radiation; heat insulation. Heat a form of energy; produced by friction; conservation of energy; units of heat, calorie, B.Th.U., therm. *Mechanical equivalent of heat; its determination by simple methods; simple treatment of steam engines and internal combustion engines.*

Specific and latent heats; calorific values of fuels and foodstuffs.

Measurement of specific and latent heats by the usual simple methods *and by methods involving the thermal capacity of a thin calorimeter.*

Vapour pressure, boiling point, atmospheric humidity and dew point, cloud, mist and fog. *Influence of pressure on boiling points of liquids and of dissolved substances on freezing and boiling points of liquids.*

4. Light; rectilinear propagation, shadows, eclipses. Reflection and refraction at plane surfaces; prisms; spherical mirrors and lenses (graphical methods of determining position and size of images will be sufficient). *Snell's law. Total internal reflection; critical angle.*

Camera, projector; the vertebrate eye, *long and short sight, astigmatism and corrections; simple forms of telescope and microscope.* Dispersion; colours of natural objects. *Elementary descriptive treatment of wave motion; propagation of radiant heat and light (including simple experiments to test the law of inverse squares); simple photometers. Production of a pure spectrum; the ultra-violet and infra-red regions. Absorption of light by coloured substances, e.g. chlorophyll.*

5. Sound; due to vibration; transmitted by material medium; rough idea of velocity

Reflection of sound, echoes. Pitch related to frequency; frequency of vibrating string related to length and tension. *Resonance.*

Measurement of the velocity of sound by large-scale experiment.

6. Production and properties of simple magnets, permanent and temporary magnets, the earth as a magnet. Electric current; heating effects; magnetic effect in straight wire and solenoid (including polarity rules); electromagnets; the electric bell; the telephone.

Potential difference, current strength, quantity, resistance, *electromotive force*, (practical units).

Ohm's law; series and parallel connections of cells and resistances.

Equivalent resistance of resistances in series and in parallel. Wiring of buildings; switches and fuses.

Watt, kilowatt-hour with simple numerical application of the transformations of electrical energy. Electrolytic decomposition of water; copper plating; *laws of electrolysis; simple cell, polarization.*

Descriptive account of the construction of Leclanché cell, dry cell and lead accumulator; use of these cells. Galvanometers (excluding tangent galvanometer) and connections for use as ammeters and voltmeters, D.C. motor.

Simple experiments illustrating electromagnetic induction and a simple study of its application to A.C. and D.C. generators. Experimental treatment of applications of alternating current; transformers. Advantages of high voltage transmission.

*7. *Apparent diurnal motion of sun, moon and stars. Rotation of earth: time and longitude. The moon, its motion, phases, eclipses. Tides and their connection with the sun and moon. Apparent annual solar motion. Earth as a planet; "tilt" of axis; seasons; length of day in relation to latitude. Distinction between fixed stars and planets based on weekly observation of position of planet. Solar system in outline; characteristics of the major planets. Newton's law of gravitation (qualitative). Comets and meteors. The sun as nearest star—sunspots, eclipses. Recognition of Great Bear, Orion, Cassiopeia, Pleiades, Pole Star, Sirius, Aldebaran, Arcturus, Vega.*

*8. *The nature, origin, occurrence and uses of the common igneous, sedimentary and metamorphic rocks of Britain, e.g. granite, basalt, sandstone, shale, limestone, chalk, coal, slate and gneiss. An elementary knowledge of denudation and deposition and the land forms arising. The evidence of and results of earth movements—raised beaches, submerged forests, folds and faults. The succession of life on the globe: invertebrates—fishes—amphibia—reptiles—mammals; Algae—spore plants—seed plants—flowering plants. The principles of the sub-division of geological time and the general conditions which prevailed in Britain in past periods.*

9. Elements and compounds; mixtures. The notion of atoms and molecules and use of equations in so far as they assist in giving a picture of chemical action. Law of conservation of mass; equivalence and valency; the use of chemical equations for simple calculations on weight relationships; types of chemical change; reversible action; catalysis; allotropy.

10. Air; approximate composition of atmospheric air; general properties and functions of oxygen, nitrogen, carbon dioxide and water vapour. Liquid air as a source of oxygen.

Water; synthesis and electrolysis.

Laboratory preparation of, and tests for, oxygen, hydrogen, carbon dioxide.

Oxidation; combustion, respiration and rusting; gain in weight on oxidation; acidic and basic oxides; the bunsen flame; flame and explosion; slow oxidation of phosphorus.

Reduction by hydrogen, carbon and carbon monoxide; reduction of litharge in laboratory and of iron ore in industry. Carbon monoxide produced by incomplete combustion, poisonous character.

11. Solutions; solubility of gases (including air) and of solids in water; effect of temperature and pressure on solubility of gases; effect of temperature on solubility of solids; crystallization by cooling or evaporation, water of crystallization, separation of mixtures by solution, filtration, crystallization and distillation; dialysis, crystalloids and colloids.

12. Appearance and general characteristics of common laboratory chemicals such as the three mineral acids, caustic soda, ammonium hydroxide, litharge, copper oxide and the following common salts: sodium chloride, sodium sulphate, calcium chloride, calcium sulphate, copper sulphate, ammonium chloride, ammonium sulphate, potassium nitrate.

General properties of acids, bases and salts. Laboratory preparation of sulphuric, hydrochloric and nitric acids and of ammonia. Preparation of dry crystalline salts by the action of acids on metals, on soluble and insoluble bases and on carbonates.

General methods of salt formation. Preparation, properties and uses of the more important salts of sodium and calcium (including silicates), zinc and copper.

13. The carbonates and bicarbonates of sodium and calcium; temporarily and permanently hard waters and their softening; quick and slaked lime and their uses.

14. General characteristics (physical and chemical) of metals and non-metals and their common oxides; study of carbon, sulphur and chlorine; properties and uses of sodium, magnesium, calcium, copper, zinc, aluminium, tin, lead and iron including the alloys bronze, solder, duralumin and brass.

* Questions on other parts of the syllabus will be set as alternative to any questions on astronomy and geology.

15. Coal, wood and oil as fuels. Destructive distillation of coal, simply treated; coke, coal (not "household") gas, ammoniacal liquor, tar. Chief products of distillation of crude oil.

Producer gas, water gas and methane.

16. Carbohydrates (cellulose, starch, sucrose and glucose), proteins, fats and their recognition by simple tests. *Digestion of protein, fat, starch and sucrose; hydrolysis. Preparation of ethyl alcohol from sugar. Preparation of ethyl acetate and comparison of an ester with a salt. Fats, glycerol and soap.*

17. The nitrogen and carbon cycles simply treated; *chemical fixation of nitrogen.*

18. Soil; simple treatment of origin; composition—sand, clay, humus, mineral salts and living organisms, and their respective functions in drainage, aeration, water retention and plant nutrition. Functions of lime and nitrogenous fertilizers.

Importance of salts in plant nutrition as shown by water or sand culture methods. The broad principles of manurial treatment and rotation of crops.

19. The cell as the unit of life; respiration, nutrition, multiplication by simple fission (no details). Amoeba and Spirogyra simply treated as examples of undifferentiated animals and plants; *Hydra, as exemplifying differentiation and specialization of cells and as a prototype of a multi-cellular animal.*

20. Herbaceous plants; general structure—root, stem, leaves, inflorescence, fruit and seed—studied with reference to some common named examples. Root functions, osmosis (including a demonstration with a non-living membrane); diffusion. Transport, transpiration, respiration, photosynthesis, test for starch; etiolation; *conditions affecting dry weight.*

Pollination; fertilization illustrated by a study of fusion of gametes in flowering plants, *Vaucheria and Spirogyra.* Fruits and seeds; their dispersal by wind and by animals (two examples of each). Food reserves and their storage in seeds and other plant structures. The structure of the Broad Bean seed, and the morphological and simple chemical changes which occur during its germination. Vegetative propagation and its function *including grafting and budding.*

The form, life-cycle and physiology of the woody perennial and such features of structure of herbaceous plants and woody stems as require the use of a hand-lens for identification.

21. Simple study of man or other mammal. General structure, including approximate location of principal organs; elementary study of a limb and its movement. Digestive, respiratory, circulatory and excretory systems excluding lymphatic system; nature and function of blood, lung and intestinal walls, and skin. A simple treatment of food digestion, assimilation and food values. (Ptyalin or diastase, and pepsin are the only enzymes whose names will be expected and whose action need be studied experimentally.) Essentials of reproduction in a mammal.

22. Response to stimuli; phototropism, geotropism and hydrotropism in plants; function of nervous system and sense organs, simply treated.

23. *Further study without microscopic details, of the structure and function of the following systems in a mammal or frog, and in the human being. Digestive: salivary glands, gastric juices, pancreas, liver. Excretory: kidneys and bladder. Respiratory and circulatory: lungs, blood, heart, main arteries and veins (only the following need be named: aorta, pulmonary, venae cavae), capillaries. Nervous: central nervous system, brain and spinal chord including the action of a spinal nerve (names of nerves not required), reflex arc. Reproductive system of a mammal.*

Vitamins and hormones in connection with growth and health.

24. Houseflies, bacteria and fungi as agents of decay and disease (it is expected that candidates will know that bacteria are small unicellular organisms feeding on organic matter and multiplying by fission); methods of food preservation and their underlying principles. *Yeast and one mould examined to illustrate significance of organisms in decay and fermentation.*

25. *Comparison of the nutrition of animals, fungi and green plants; special methods of nutrition such as insectivorous plants, parasites and saprophytes.*

26. Life history of the frog, a housefly, ant or bee and moth or butterfly; the mosquito in relation to the malarial parasite.

(O 40) AGRICULTURAL SCIENCE

Syllabuses may be submitted for approval. Applications for approval must be made at least eighteen months before the examination concerned.

(O 41) HUMAN BIOLOGY (one paper of three hours)

Human Biology may not be offered at the same sitting of the examination as either Zoology or Biology (Ordinary or Advanced).

Although the subject ranks at the Ordinary level, questions set will be more suitable for candidates who have already completed at least part of their Sixth-form or similar higher course.

Eight questions will be set of which a candidate will be required to answer five.

Candidates will be expected, wherever possible, to show in their answers that they have done some practical work and made personal observations on the subjects they are discussing.

The structure of the Human Body in such detail as is necessary to understand the elementary principles of its physiology.

1. Protoplasm; the cell; tissues illustrated by epithelia, muscle, nerve, cartilage, bone, blood; the aggregation of tissues into organs.

2. The skeleton (excluding skull bones) and its functions. Immovable joints; movable joints, illustrated by ball and socket joint, hinge joint, gliding joint. Teeth. The skeleton and muscles in relation to simple limb movements and posture.

3. Nutrition. The constituents of food and their uses; balanced diets; energy requirements. Simple food tests. The alimentary system, digestion and absorption, enzymes and their action.

4. Respiration, internal and external; the anatomy and physiology of the respiratory system. Artificial respiration.

5. The functions of the blood. Simple treatment of blood groups and the Rh-factor. Heart, main blood vessels, lymph, circulation.

6. Constancy of the internal environment. The skin and its regulating function. Excretion, lungs and kidney.

7. Control of the body by nervous and endocrine mechanisms. Sense organs. Eye. Ear. Reflex action. Voluntary and involuntary action. Habit formation. Outline only of the autonomic system.

8. Position, structure and functions of the male and female reproductive organs. The menstrual cycle, ovulation, fertilisation, and an outline of the development to include implantation, the functions of the placenta (no details of structure are required), parturition. Mammary glands and milk.

9. Conditions favourable and unfavourable to health. Agencies of disease, transmission of disease. Resistance of the body; immunity, natural and acquired.

10. Personal and social hygiene. Personal health, food, housing, ventilation, lighting, heating, water supplies, sanitation. The Health Services.

(O 42) WOODWORK (one paper of three hours and a practical examination)

Woodwork may not be offered at the same sitting of the examination as Paper III in Art (Advanced).

Questions may be set which test a knowledge of elementary safety precautions in the use of tools or equipment.

A. Design and Drawing

Candidates will be required to produce a solution to a simple planning problem for which relevant data will be given. The type of problem set will be based on the constructions listed in the syllabus for the practical examination. The solution is to be presented as follows:

(a) Preliminary freehand drawings showing pictorial views together with written notes and sketches of details as necessary.

(b) From his preliminary work the candidate will be required to choose one design for which he is to produce a working drawing, fully developed in orthographic projection in accordance with the provisions of *British Standard Engineering Drawing Practice* (B.S. 308) in force on 1 September 1965. The drawing may include either vertical or horizontal sections at the candidate's own discretion. First angle projection only will be expected. Marks will be awarded both for quality of ideas and for draughtsmanship.

Candidates will be informed about three months before the examination of the prescribed subject or theme on which the design question will be based. They will be required to bring to the examination a single sheet, not exceeding half-imperial in size, of preliminary studies made by them in preparation for the paper. During the examination candidates will be free to refer to these preliminary studies which are subsequently to be forwarded to the examiner with the work done in the examination room.

B. *Technology*

Tools

Common woodworking tools and their uses, construction and mechanical principles. Sharpening and general maintenance. Abrasives.

Materials and processes

Timber: growth, conversion and seasoning. Common causes of damage and decay of green or seasoned timber. Preservation. Distribution, sources of supply, characteristics and uses of common timbers such as Douglas fir, European redwood, European whitewood, yellow pine, ash, beech, birch, mahogany, obeche, teak, walnut. Market forms and the method of specification when ordering. Veneer, plywood, laminated board, manufactured sheet material such as hardboard and plastics.

General physical properties of wood: swelling, shrinkage, warping etc. Selection of timber: faults, knots, shakes etc.

Glues: workshop preparation and uses of the various kinds of glue, hot and cold. Fixing devices: nails, screws, bolts, dowels. Simple hinges: tee, backflap, butt. Fastenings: slip bolts, ball catches.

Construction, processes and finishes; common joints and their uses, particularly those referred to in the syllabus for the practical examination. Representation by means of sketches (pictorial or orthographic), preparation of a cutting list from dimensioned drawings. The application of the above to the three main types of construction work: stool or table construction; flat frame construction, e.g. simple doors, including simple hinges and fastenings; box or carcass construction, e.g. cupboards and drawers.

C. *History*

The history of furniture for the English home from about 1500 to the present day with special reference to the following: the work of the carpenter, joiner, cabinet maker and designer; the development of domestic forms of the chair, chest and table. Candidates will be expected to make reference where appropriate to social and foreign influences on the work of craftsmen and on the design of furniture. Credit will be given to candidates whose answers show evidence of study of actual examples of good craftsmanship.

Practical examination (three hours)

Working from dimensional sketches and from scale drawings. Constructions involving one or more of the following types of joint: halving; housing (through and stopped); bridle; mortise and tenon (through or stopped, plain, haunched, with or without a groove, or with a rebate); edge-jointing; mitring; scribing; dovetail (common and lapped). Fastening by nails and screws. Simple hinging.

Appropriate decoration. Shaping with chisel, scribing gouge and spokeshave.

(O 43) METALWORK (one paper of three hours and a practical examination)

Metalwork may not be offered at the same sitting of the examination as Engineering Workshop Theory and Practice.

Questions may be set which test a knowledge of elementary safety precautions in the use of tools or equipment.

General: tools, materials, processes

1. *Tools*

Common kinds; mechanical principles underlying their construction and use. Sharpening and maintenance. General knowledge of a simple lathe and drilling machine.

2. *Materials and processes*

Metals. Sources and distribution. An elementary knowledge of the extraction and production of common metals and alloys and of their conversion to marketed forms.

General physical and working properties of common metals and alloys and an elementary knowledge of their composition, as related to malleability, ductility, conductivity and work hardening. Fusibility of common solders. Mechanical strength. Tension, compression, shear.

The gas blowpipe. Combustion of coal gas. Oxidation and reduction. Heat treatment. Annealing, hardening and tempering carbon tool steel. Case hardening. Soldering. Hard and soft solders, fluxes, capillary action. Sweating. Simple casting.

Lubrication, lubricants.

History and Design

3. *History*

Either

(a) *(For candidates offering hammered metalwork)*

A general historical outline of decorative or architectural metalwork. Methods of metalworking developed from the malleability and fusibility of the material.

Hammered work—the artist and smith. Goldsmith, silversmith, coppersmith and blacksmith. Domestic silverware, ceremonial plate and church metalwork.

Cast work—the combined effort of artist, modeller (or sculptor) and founder. English leadwork, bronze statuary and decorative metalwork applied to buildings.

Or

(b) *(For candidates offering engineering metalwork)*

The broad historical development of the production and use of iron and steel. Engineering metalwork. Progress through need, discovery, invention and research.

Under either alternative questions may be set which will give candidates the opportunity of showing their knowledge of any local metalwork craft.

4. *Constructional design*

Design as applied to hand-produced metal objects made to satisfy simple specified purposes and conditions reasonably within a candidate's experience or his power to visualize.

Considerations of fitness, proportion, material, details of construction. Form. Surface and edge enrichment. Finish. Representation of the above objects, which may involve lathework, by hand sketches, oblique or first angle orthographic projection.

Practical examination (three hours)

Working from dimensional sketches and from scale drawings.

Either

(a) *Hammered metalwork.* Application of the processes included in this section of the syllabus to brass, copper and gilding metal. Basic bench operations such as cutting with chisel, shears and hacksaw. General filing, riveting, threading with taps and dies. Soft soldering, repeated hard soldering with graded solders. Brazing. Folding, bending, circular hollowing and raising. Planishing, annealing, cleaning. Piercing and outline filing. Built up work, fitting and butt jointing components—limited to cylinder and cone. Simple turning. Tooled and applied decoration—at candidates' choice. Finishing. Tool making, e.g. scriber, cold chisel, punch.

Or

(b) *Engineering metalwork.* Cutting with chisel, shears and hacksaw. General use of files. Beveling and rounding edges. Draw filing. Drilling, riveting, threading with taps and dies. Chopping out with chisel. Cold bending. Simple forging: drawing down, bending, twisting. Annealing. Hardening and tempering carbon tool steel. Case hardening. Simple brazing. Folding, lapping, seaming and wiring thin sheet. Developing, cutting out, bending and soft soldering a simple form of tray or similar object of regular geometrical outline—excluding the cone.

Lathework will be excluded from the practical examination but **the theory paper may contain questions based on the assumption that candidates are familiar with simple lathe work made between centres or in a self-centring chuck.**

(O 44) GEOMETRICAL AND ENGINEERING DRAWING (two papers: Paper I two hours, Paper II two and a half hours)

In order to pass in the subject a candidate must satisfy the examiners in each paper separately.

I. Geometrical Drawing.

1. Plane Geometrical Drawing

Division of straight lines into equal and proportionate parts. Construction of plain and diagonal scales. The circle; division of circles and measurement of angles. Problems on straight lines and circles including tangents and common tangents to two circles. Circumscribing and inscribed circles to a triangle. Construction of polygons. Reduction and enlargement of polygons to similar figures with sides or areas in given ratios. Equivalent triangles. Loci: with reference to moving parts of machines. Construction of ellipse and determination of foci.

2. Solid Geometrical Drawing

(i) Projection of points and lines. The point in space; the line in space. Figured plans. True length and inclination of straight lines.

(ii) Projection of simple plane figures; auxiliary projections.

(iii) Projection of geometrical solids, spheres, prisms, right cylinders, cones and pyramids: simple cases of auxiliary projection; new ground line. Curves of interpenetration or intersection of surfaces of solids limited to triangular and rectangular prisms and cylinders. Plan and elevation of a section made by a vertical, horizontal or inclined cutting plane. True shape of section. Surface developments.

(iv) Planes: vertical, horizontal, inclined, oblique. Rebattments. Distances of points from given planes.

(v) Simple linear helix.

II. Engineering Drawing

The provisions of *British Standard Engineering Drawing Practice* (B. S. 308) in force on 1 September 1965 should be observed in the preparation and dimensioning of drawings.

Correct projection of views of parts of machines usually found in the school workshop. Sectional views taken on a cutting plane.

Conventional representation of simple fastenings, such as rivets, nuts and bolts, and their treatment in sectional views.

Drawings of simple machine or engine parts prepared from given details of their composite parts or from note-book sketches; also from pictorial drawings of the assembled machine or engine parts. Freehand sketches and isometric drawings of hand and suitable machine tool parts used in school workshops.

(O 45) ENGINEERING WORKSHOP THEORY AND PRACTICE (one paper of two and a half hours and a practical examination of three hours)

Engineering Workshop Theory and Practice may not be offered at the same sitting of the examination as Metalwork (Ordinary or Advanced.)

Candidates will be expected to possess an adequate working knowledge of the subject-matter of the Ordinary syllabus in Geometrical and Engineering Drawing.

Questions may be set which test a knowledge of elementary safety precautions in the use of tools or equipment.

1. Materials

Principal metals used in the school workshop. General physical and working properties; strength, ductility, malleability, toughness, hardness, heat conductivity and fusibility. Simple workshop tests and methods of identification.

Forms of supply: wire, strip, flats, rod, bar, sheet. Coated sheets.

Elementary account of the heat treatment of carbon tool steels. Colour charts. Case hardening. Effects of working, e.g. work hardening. Methods of annealing.

Alloys; composition and properties of principal non-ferrous alloys including solders.

Engineering uses of the more common metals and their alloy

2. *Hand tools and processes*

Bench working tools including hammer, chisel, hacksaw, file scraper, hand drill etc.

Measuring tools including rule, callipers, dividers, vernier, vernier callipers, micrometer, depth gauge. Their limitations for accurate measurement.

Marking-out tools including marking-out table, surface gauge, angle plate, V block, try square.

Forging tools including hearth, anvil, swages, fullers, hardies.

Soldering and brazing tools including blowpipe, soldering bits. Use of fluxes.

Threading tools including taps and dies for B.S.W., B.S.F. and B.A.

Care and maintenance of tools. Sharpening of bench working tools.

3. *Machine tools*

Main features and construction of the undermentioned machine tools (including standard equipment).

Power drill (manual feed) sensitive type.

Centre lathe: centres, chucks, faceplates, mandrels and steadies.

Shaper: methods of securing the work.

Plain milling machine: vices and simple fixtures, plain, side and end milling cutters.

Lubrication and care of machine tools.

Practical Examination

Emphasis is to be laid on fundamental tool operations and correct marking out.

4. Bench work. Cutting of metal; use of hacksaw, shears, hand-shearing machine, chisel. Filing to dimensions and to a fit. Screw cutting with taps and dies, tapping and clearance sizes. Marking out—use of marking-out table and associated equipment.

5. Forging: use of hearth, anvil and anvil tools. Hot and cold bending, upsetting, drawing out, twisting, fullering. Hardening and tempering of bench tools, e.g. chisels and punches.

6. Drilling: use of hand and breast drills, drill point angle. Use of power drilling machine, speed of drilling, high speed drills.

7. Joining of metal; riveting; hard soldering and brazing using blowpipe and brazing hearth.

8. Sheet metal work: folding, lapping, seaming, wiring. Joining by self-secured joints. Soft soldering. Surface development of simple geometrical forms.

9. Machine work—turning on the lathe between centres and in the chuck. Surfacing and boring, taper turning and knurling. The use of shaping machine, production of flat surfaces. Simple operations with the milling machine.

Questions set in the theory paper will be based on the assumption that candidates are familiar with all the above processes but the practical examination will not involve §§5, 7 and 8, nor will it include work on milling or shaping machines.

(O 46) GENERAL ENGINEERING SCIENCE (two papers each of two hours)

Paper I will include four questions on Mechanics (Section A) and four on Chemistry (Section B).

Paper II will include four questions on Heat and Light (Section A) and four on Electricity, Magnetism and Sound (Section B). In each paper candidates will be required to answer five questions including at least two from each section.

It is expected that both the scientific principles or ideas mentioned at the beginning of each section and the "applications" which follow will be verified or demonstrated experimentally. The main study should be of the "applications" and questions will be set only on the topics included under the heading of "applications" in each section.

PAPER I.

Section A (Mechanics)

Direct methods of measuring length, force, time, density, velocity, acceleration.

Meaning of pressure, elasticity, work, power, energy.

Meaning of gravitation, surface tension, "centrifugal force", friction.

Principle of moments. Archimedes' principle. Parallelogram of vectors.

Conservation of energy. Bernoulli's principle (treated qualitatively).

Boyle's law.

Applications

Micrometer screw gauge, vernier callipers. Use of standard sizes for screw threads, twist drills, wire gauges, gear tooth proportions.

Spring balance, steelyard, simple weighing machines.

History of time measurement. Use of simple pendulum and bar pendulum. Path of projectile (treated graphically). Types of tachometer.

Use of manometers. Bourdon pressure gauge. Tyre pressure gauge (pocket type). The siphon. Domestic water tap.

Lift and force pumps. Car petrol pump (diaphragm type). The bicycle pump and its adaptation as a vacuum pump or as a means of filling a balloon with coal-gas. Load lines on ships. Automatic ball tap, carburettor, petrol gauge. Hydraulic press. Hydraulic brakes on a car. Elastic bending of a beam with single load. Leaf springs on a car. Meaning of yield point and ultimate strength.

Meaning of centre of gravity. Stability applied to toppling vehicle.

Capillarity and its effects in buildings. Porosity of bricks. Voids in sand.

Simple machines: levers, pulley systems, inclined plane and screw. Winch, screw jack, bench vice.

Transmission of power with simple gear trains, chain and belt drive arrangements. Worm and worm wheel.

Reasons for automobile gear box, action of simple gear box. Three speed gear ratio on bicycle.

Gear pump as used for engine lubrication.

Common examples of energy transformation.

Meaning of horse-power. Relationship between watts and horse-power.

The centrifuge separator, ball speed governor, balance of flywheel. The friction clutch, variable friction drive, e.g. on a coil winder.

Use of fluid friction in hydraulic shock absorber on car, pneumatic door check.

Physical and working properties of steel, wood, tufnol, perspex.

Section B (Chemistry)

Elements, compounds and mixtures. Chemical and physical changes. Processes of filtration, distillation, crystallization. Use of centrifuge.

The idea of atoms and molecules. Use of chemical equations.

Composition of air and water. Properties of oxygen, nitrogen, carbon dioxide, ammonia.

Meaning of oxidation and reduction. General characteristics of metals and non-metals.

General properties of acids, bases, salts, including carbonates, oxides.

Applications

Physical and chemical tests to identify aluminium, tin, lead, zinc, copper, iron.

Production of cast iron. Rusting of iron.

Corrosion of other metals. Use of protective coatings.

Simple examples of electrolytic corrosion.

Use of quicklime and sand in mortar. Weathering of mortar. Plaster of Paris.

Laboratory preparation of glass. Working properties of glass. The nature of coal, coal gas, petrol, paraffin, calor gas, and the products of their combustion.

Manufacture and combustion of water gas, producer gas.

Manufacture of calcium carbide. Acetylene and its uses.

Freezing mixtures produced with and without the use of ice. Use of "dry ice".

Composition of common alloys, e.g. brass.

Mercury amalgams. Mirror surfaces on metal and glass.

Fire extinguishers using acid with bicarbonate, carbon tetrachloride.

Commercial uses of electrolysis; the accumulator. Electro-plating on an insulator using plumbago. Pole-testing paper.

Tests to identify commonly used solutions, e.g. sulphuric acid, caustic potash, sodium carbonate.

Discovery of inert gases and their uses.

Cleaning agents, e.g. grease-solvents, soaps.

Laboratory preparation of cements to use with glass, perspex.

Hardness of water, its cause, effects and removal.

PAPER II

Section A (Heat and Light)

Meaning of heat, temperature, Centigrade (Celsius) and Fahrenheit scales, absolute zero, calorie, B.Th.U., therm.

Meaning of conduction, convection, radiation, thermal expansion.

Measurement of specific heat, latent heat, melting point, boiling point.

Mechanical equivalent of heat. Heating effect of electricity in B.Th.U. per kilowatt-hour.

Rectilinear propagation of light. Laws of reflection and refraction.

Use of ray diagrams to show image formation by reflection and refraction.

Meaning of focal length, power of lenses and mirrors.

Dispersion and the spectrum.

Meaning of candle power of a lamp, intensity of illumination in foot-candles.

Applications

Simple liquid-in-glass thermometers. Temperature measurement utilizing a thermocouple, "disappearing filament", bi-metal strip, calorimetry, melting points.

Vapour pressure thermometer as used for car water-cooling system.

Low melting point alloys, e.g. solder. Use of fusible plugs.

Use of "anti-freeze" in cars.

The pressure cooker.

Calorific values of coal, coal gas, petrol, paraffin, calor gas.

Cooling by forced evaporation. The ammonia refrigerator.

Everyday effects of thermal expansion, change in volume with change of state.

Importance of atmospheric humidity. The hair hygrometer.

Thermostats, e.g. bi-metal strip type, gas oven type, mercury expansion type.

Everyday uses of good and bad conductors. The vacuum "thermos flask".

Domestic hot water system. Water-tube boiler (e.g. Babcock and Wilcox).

Fire-tube boiler (e.g. locomotive). Boiler accessories and safety devices.

Efficiency of electric kettle compared with use of kettle on gas ring.

Action and historical development of reciprocating steam engines.

Action of four stroke internal combustion and compression ignition engines.

The sextant, periscope, optical range finder, pinhole camera, lens camera, eye.

Elementary technique of photography, e.g. choice of lens aperture and shutter speed.

Simple telescopes and microscopes. The lantern slide projector.

Colours of the rainbow and pigments. Three colour printing process.

Elementary properties of infra-red and ultra-violet radiation. The photo-voltaic type illumination meter and its adoption to measure candle-power. Efficiency of electric lamps as watts per candle power.

History of development of electric lamps.

Section B (Electricity, Magnetism and Sound)

Elementary properties of magnets and magnetic materials.

Qualitative treatment of simple electro-state theory.

Meaning of ampere and volt. Ohm's law and the meaning of resistance.

Factors affecting the resistors of a conductor. Resistances in series and in parallel.

Relation between watt, ampere and volt. The kilowatt-hour.

Magnetic fields due to a current flowing in straight wire and solenoid.

Qualitative laws of electro-magnetic induction and electro-dynamics.

Alternating current and elementary A.C. measurements.

Sound as vibration. General features of sound, radio and light waves.

Applications

Moving iron and hot wire ammeters. The moving coil milliammeter and its use with shunts, multipliers and rectifier for A.C. measurement. Simple ohm-meters. The universal meter.

Practical uses of electricians' wire tables.

Construction of resistors, volume controls in radio sets. Colour code for carbon resistors.

Effect of using alternating current instead of direct current for resistance measurements.

The watt-meter. Power absorbed by a number of lamps (resistors) in series or in parallel.

Relative merits of dry battery, lead-acid accumulator, alkaline accumulator.

Use of series and parallel connections with batteries. Care of accumulators.

The electro-magnet, trembler bell, car "trafficator", solenoid switch (e.g. car starter).

The P.O. relay and its use in simple signalling circuits.

The induction coil and its uses. Car ignition system, car speedometer.

A.C. transformers; reasons for use in national grid system.

Use of fuses. Electric smoothing iron, soldering iron, kettle and fire. Resistance welding.

Conduction through gases. Discharge lamps. Uses of carbon arc.

Types of capacitor and their uses. Testing capacitors for serviceability.

The C-R circuit for a flashing neon lamp. The stroboscope.

General features of, and simple control circuits for, small D.C. motors and generators.

Synchronous A.C. motor as in electric clock. The bicycle dynamo as an A.C. generator.

Small rotary A.C./D.C. converters. Use of metal rectifiers for alternating current and direct current.

Tests to distinguish alternating current from direct current.

Simple domestic wiring circuits and type of wire used. Switches, sockets, plug tops.

The moving coil loudspeaker. Car hooter.

The telephone receiver, carbon microphone. Simple telephone circuits.

The L-C resonant circuit. Crystal radio receiver, spark transmitter.

(O 47) SURVEYING (one paper of three hours)

Before being awarded a pass in the subject a candidate is required to produce evidence of satisfactory course work (see §10 below).

Candidates will be expected to possess an adequate knowledge of the subject-matter of Mathematics (O 25) Syllabus A.

1. Introduction

The purpose of maps and plans. Map scales. Conventional signs. Contours.

2. Basic principles of surveying

Methods of fixing a point in relation to a base line—rectangular offsets, angle and distance, triangulation.

3. Chain surveys

The use of chains, tapes, the cross staff, the optical square etc. Chaining on sloping ground. Chaining round obstacles. Use of the field book.

The layout of chain surveys. Check measurements. The use of offsets and tie lines. Plotting.

4. Levelling

Description and use of the dumpy level or other types of internal focusing level. Methods of booking. Check observations.

Plotting vertical sections.

Contouring. The use of the hand level and the Abney level.

5. Transverse surveying

True and magnetic north. Whole circle and reduced bearings. Open and closed traverses. Closing errors.

Plotting by protractor, tangents and rectangular coordinates.

6. The prismatic compass

Description of the prismatic compass and its use for approximate surveys.

7. The plane table

Description and elementary use.

8. The theodolite

Description of the vernier theodolite. Its use for line ranging and the measurement of horizontal and vertical angles.

9. *Areas*

The measurement of areas. The use of the mid-ordinate rule and Simpson's rule.

10. *Course work*

A candidate will be required to produce evidence of satisfactory course work before being awarded a pass in the subject.

Field notes and plans in relation to each of the following are to be submitted:

- (a) A chain survey.
- (b) A theodolite or compass survey.
- (c) Levelling and contouring (as included in **either** (a) **or** (b)).

(O 48) NAVIGATION (one paper of two and a half hours)

The mathematical basis of the work covered by the syllabus is regarded as of great importance.

A. *Instruments, charts and coastal navigation*

1. Brief description of the principles and use of Mercator and gnomonic charts.
2. Compasses, magnetic and gyro. Variation and deviation. The conversion of courses and bearings. Radio D.F. bearings and their reduction to Mercatorial bearings.
3. Methods of finding the ship's position by terrestrial objects. Coastal navigation. Plotting on the chart. Cross bearings. Running fixes. Shaping courses allowing for a current or tidal stream.
4. Horizontal sextant angles. Station pointer fixes. Vertical danger angles. Transits.
5. Elementary principles of the sextant. Instrumental errors and adjustments. Methods of finding index error. The corrections to be made to a sextant altitude.
6. Signs and abbreviations in use on Admiralty charts.

B. *The sailings*

1. Elementary geometry of the sphere. Definitions.
2. The traverse table. Plotting charts and their use.
3. The sailings: rhumb line plane and Mercator, middle latitude, parallel and great circle (distance, courses and vertex; a knowledge of the haversine or cosine formulae and Napier's Rules will be expected, but proofs of the formulae will not be required). Day's work.

C. *Nautical astronomy*

1. The celestial sphere. The triangle PZX . Definitions. Figure drawing.
2. The motion of the sun. Mean time. Zone time. Sidereal hour angle. L.H.A. and G.H.A. Right Ascension.
3. The theory of the astronomical position line. The geographical position of the sun. Calculation of position line by finding intercept and azimuth of the sun (including the use of ABC tables for finding the azimuth).
4. Calculating the time of the sun's meridian passage. Estimating the meridian altitude. Latitude from the sun's meridian altitude.
5. Transferring the astronomical position line. Obtaining the observed position from sun sights by plotting on the chart.
6. Use of tables and of spherical trigonometry to find azimuth of sun and thence compass error.

(O 49) SEAMANSHIP, SIGNALS AND RULE OF THE ROAD (one paper of two and a half hours and a practical examination)1. *Elementary theory of simple machines used at sea*

Lever, inclined plane, wheel and axle, screw jack, barrels and drums of winches, capstan, crab winch, differential purchase, pulleys and purchases. (Questions may be set on velocity ratio and mechanical advantage, relation between load and effort, efficiency, principle of work and overhauling, approximate formulae allowing for friction in the simple tackle.)

2. Application of triangle of forces

Composition and resolution of forces. Graphical construction to find the resultant of coplanar forces. Stresses and tensions in spans, topping lifts, derricks, masts, stays, guys and slings. Simple questions on pressure on sails and propulsion of sailing boats.

3. Elementary stability

Stable, unstable and neutral equilibrium on plane surfaces. Archimedes' principle, laws of flotation and pressures on hull; buoyancy and reserve buoyancy, displacement. Centre of buoyancy, centre of gravity, metacentre (transverse only). Heeling of a sailing boat and experimental determination of metacentric height. Righting couples for small angles and elementary calculations. Effect on centre of gravity of shifting, adding and taking away weights. Ballast.

4. Magnetic compass

Magnetic poles, magnets and field strength. Application of triangle of forces and couples to the compass needle. Compass card, binnacle and elementary ideas of correctors. Finding the magnetic bearing of an object (excluding astronomical methods). Simple ideas of terrestrial magnetism, magnetic poles and equator, dip variation, horizontal force, vertical force. Dry and liquid compasses.

5. Soundings

Principle of echo soundings. Elementary ideas on equipment. Recorder, transmitter, receiver. Magnetostriction. Supersonic type of echo sounder. Electrolytic recorders. Errors. Kelvin sounding machine. Principle of and simple calculations on the Kelvin sounding machine. Operation of machine and taking soundings with beam and stern types. Causes of incorrect soundings.

6. Measurement of speed and distance

Elementary calculations. Principle of hand log and Dutchman's log. Rotator logs, taffrail and beam types. Principle, streaming and housing, care and maintenance of rotator logs. Errors and corrections.

Practical Examination

The practical examination may include tests on any of the following. Items 3 and 5 will be construed as related to Merchant Navy practice only.

1. Bends, hitches, knots, splices, whippings, wire splicing, seizings, worming, parcelling, serving.
2. Cordage, steel wire rope, canvas, sailmaking.
3. Different builds of boat, parts of a boat, hoisting and lowering, stowage, davits (Welin and radial types).
4. Handling and management of boats under oars, sail and power.
5. Anchors, stowage of anchors, chain cable, care in working, fittings used in anchor work.
6. Lifebuoys, life jackets, life-saving apparatus, Schermuly line-throwing apparatus.
7. Semaphore, morse light.
8. International code and procedure.
9. International regulations for preventing collisions at sea.

(O 50) DOMESTIC SCIENCE

SYLLABUS A: DOMESTIC SCIENCE (FOOD)

SYLLABUS B: DOMESTIC SCIENCE (CLOTHING)

SYLLABUS C: DOMESTIC SCIENCE (FOOD AND CLOTHING)

Domestic Science may not be offered at the same sitting of the examination as either Housecraft (Advanced) or Needlework and Dressmaking (Advanced). Syllabuses B and C may not be offered at the same sitting as Alternative J (Dress) in Craft (Design and Practice).

A candidate may offer either Syllabus A or Syllabus B or Syllabus C (each of which will count as one Ordinary subject) or Syllabus A with Syllabus B (as two Ordinary subjects). Syllabus C may not be offered together with either Syllabus A or Syllabus B.

In all papers candidates will be expected to show that they have knowledge of the elementary science necessary for the proper understanding of the processes involved, but questions dealing with scientific principles will have particular reference to their practical application.

In order to pass in the subject a candidate must satisfy the examiners in the theory paper.

SYLLABUS A. DOMESTIC SCIENCE (FOOD) (one paper of two and a half hours and a practical examination)

1. The planning of houses with particular attention to the working area. The functions and principles underlying the construction of all kitchen equipment and utensils, including gas and electric cookers, gas and electric refrigerators, solid fuel stoves and household water-heating appliances. Different systems of heating, lighting and ventilating the living and working areas of the home.

2. Electricity as a source of energy: the heating effect of a current; the meaning of common electrical terms in relation to appliances; the purpose of the fusebox; the reading of gas and electricity meters; charges for gas and electricity.

3. Elementary human hygiene and physiology sufficient for the understanding of the functions of the body, e.g. nutrition, digestion, absorption, circulation and respiration. Cleanliness in relation to the supply and handling of food. The prevention of accidents in the home.

4. The classification of food; principles of nutrition. The processes involved in cooking; the effect of cooking processes on the main constituents of food and on its digestibility. Raising agents. Seasonal preservation of food in the home. Processes of decay (fermentation, souring and putrefaction).

5. Menus for the family; choice, cost, preparation, cooking and serving of simple meals for everyday and special occasions. Invalid and convalescent cookery, food for young children, picnic meals and vegetarian dishes.

6. Laying of tables, trays and trolleys. Simple flower arrangement for table decoration.

7. The practical work done during the course should include the following: normal methods of cooking, e.g. boiling, baking, stewing, roasting, frying, casserole cookery, reheating; sauces; salads; yeast, plain cake, rich cake and ginger-bread mixtures; batters; suet and short crust pastry; grilling, simple hors d'oeuvres, sponge mixtures, flaky or rough puff pastry; the use of pressure cookers; the selective use of convenience foods.

Practical Examination (one and a half hours plus two and a half hours)

The practical examination will be based on "Meals for the family for various occasions".

In the first part of the test each candidate will be told what work she is to do in the second part and will be allowed an hour and a half in which to prepare a written plan of the dishes and the work she intends to carry out together with a list of the ingredients she will require.

In the second part, some days later, she will be required to carry out the practical work she has planned. Two and a half hours will be allowed for the second part of the test and in this time all utensils used must be cleaned.

SYLLABUS B. DOMESTIC SCIENCE (CLOTHING) (one paper of two and a half hours and a practical examination)

1. A study of natural and man-made fabrics (including crease-resistant, moth-proof, non-shrink and fire-proof finishes) in current use for clothing and household purposes with relation to their source and manufacture and their suitability, hygienic and economic value for clothing and household use.

2. Electricity as a source of energy: the heating effect of a current; the meaning of common electrical terms in relation to appliances used in laundrywork and needlework; the purpose of the fusebox; the reading of gas and electricity meters; charges for gas and electricity.

3. Home methods of laundering household linen and personal clothing; the function and the principles underlying the construction of the equipment used in home methods of laundering; the manufacture and use of cleaning agents (soap, soapless detergents, dry cleaning agents, bleaches) used for laundry and dry cleaning purposes in the home.

4. Choice of design and styles, suitable for various occasions, of personal clothing for the teenage girl. Repairing and valeting personal clothing. Choice, care and use of the tools for home dressmaking including the sewing machine and three attachments. Value and use of commercial aids to home dressmaking.

5. Selection of trade patterns suitable for different types of teenagers and occasions. The sizing and markings of trade patterns. Interpretation of the directions given with trade patterns. Simple adaptation of trade patterns for varying figure requirements and minor alterations of styles.

6. Appreciation and use of designs and embroidery in dressmaking as applied to the construction and decoration of garments.

7. The practical work should cover the cutting out, fitting and making of simply-styled lingerie, nightwear, skirts, frocks, blouses, etc. in current styles, using as wide a variety of fabrics as possible. Marks will not be awarded for course work as the value of this work is in giving candidates as wide an experience as possible with patterns and fabrics, and the fitting of garments. It is assumed that at least three garments will have been made during the course. The following processes should be included in the selection and making of garments during the course: seams, binding, facings; the use of linings and interlinings; setting in sleeves; setting on of cuffs and collars; back side and front openings suitable for frocks, skirts and underwear; disposal of fullness; fastenings including buttonholes; attaching of trimmings in current use.

Practical Examination (three hours)

Each candidate will be provided with a paper pattern and materials and will be required to make up a section of the garment illustrated to show (a) the use and economy of a paper pattern, (b) a selection of needlework processes, (c) a high standard of machine and hand stitching.

SYLLABUS C. DOMESTIC SCIENCE (FOOD AND CLOTHING) (one paper of two and a half hours and a practical examination)

1. *General*

The planning of houses with particular attention to the working area. The functions and principles underlying the construction of all kitchen equipment and utensils, including gas and electric cooker, gas and electric refrigerators, solid fuel stoves and household water-heating appliances.

The reading of gas and electric meters; charges for gas and electricity; the purpose of the fusebox.

The prevention of accidents in the home.

Elementary human hygiene and physiology sufficient for the understanding of the functions of the body, e.g. nutrition, digestion, absorption, circulation and respiration. Cleanliness in relation to the supply and handling of food.

2. *Cookery*

The classification of food; principles of nutrition. The processes involved in cooking; the effect of cooking processes on the main constituents of food and on its digestibility. Raising agents. Processes of decay (fermentation, souring and putrefaction).

Menus for the family; choice, cost, preparation, cooking and serving of simple meals for everyday and special occasions.

Laying of tables, trays and trolleys. Simple flower arrangement for table decoration.

The practical work done during the course should include the following: normal methods of cooking, e.g. boiling, baking, stewing, roasting, frying, casserole cookery, reheating; sauces; salads; yeast, plain cake, rich cake and ginger-bread mixtures; batters; suet and short crust pastry; the selective use of convenience foods.

3. *Needlework*

A study of natural and man-made fabrics (including crease-resistant, moth-proof, non-shrink and fire-proof finishes) in current use for clothing and household purposes with relation to their suitability, hygienic and economic value for clothing and household use.

Choice of design and styles, suitable for various occasions, of personal clothing for the teenage girl. Repairing and valeting personal clothing. Choice, care and use of the tools for home dressmaking including the sewing machine. Value and use of commercial aids to home dressmaking.

Selection of trade patterns suitable for different types of teenagers and occasions. The sizing and markings of trade patterns. Interpretation of the directions given with trade patterns. Simple adaptation of trade patterns for varying figure requirements and minor alterations of styles.

The practical work should cover the cutting out, fitting and making of simply-styled lingerie, nightwear, skirts, frocks, blouses, etc. in current styles, using as wide a variety of fabrics as possible. Marks will not be awarded for course work as the value of this work is in giving candidates as wide an experience as possible with patterns and fabrics, and the fitting of garments. It is assumed that at least two garments will have been made during the course. The following processes should be included in the selection and making of garments during the course: seams, binding, facings; setting in a simple plain sleeve; setting on a "Peter Pan" collar and a straight collar; back, side and front openings suitable for frocks, skirts and underwear; disposal of fullness; fastenings including buttonholes; attaching of trimmings in current use; simple embroidery stitches.

Practical Examination

Candidates offering Syllabus C will be required to take a practical examination in either Cookery or Needlework, but it will be assumed that all candidates will have done practical work in both subjects during the course. At least two garments should have been made during the course.

Cookery (one and a half hours plus two and a half hours)

The practical examination will be based on "Meals for the family for various occasions".

In the first part of the test each candidate will be told what work she is to do in the second part and will be allowed an hour and a half in which to prepare a written plan of the dishes and the work she intends to carry out together with a list of the ingredients she will require.

In the second part, some days later, she will be required to carry out the practical work she has planned. Two and a half hours will be allowed for the second part of the test and in this time all utensils used must be cleaned.

Needlework (three hours)

Each candidate will be provided with a paper pattern and materials and will be required to make up a section of the garment illustrated to show (a) the use and economy of a paper pattern, (b) a selection of needlework processes, (c) a high standard of machine and hand stitching.

(O 53) TEXTILES (one paper of two and a half hours)

1. *Introductory*

Nature of fibres, filaments, yarns and fabrics. General characteristics of the principal textile fibres.

2. *History*

Early history of textiles. Hand crafts. The Craft Guilds. The invention of machinery; The Industrial Revolution. The advent of man-made fibres in the age of chemistry. The growth, location and magnitude of the textile industries of the world and their relation to national economy.

3. *Production of fibres*

Silk, the silk-worm and the mulberry bush. Flax, jute and hemp. Wool and the farmer; principal wool-growing countries, wool sorting. Cotton; principal cotton-growing regions, harvesting, ginning and baling; cottonseed by-products. Man-made fibres obtained from wood pulp, cotton linters and coal-tar products.

4. *Properties and identification of fibres*

Staple length and fineness and their influence on yarn qualities, as exemplified by cotton and wool. Moisture regain. Cotton and its convolutions. Wool and its scales. Cross-sections (cotton, flax, silk, rayons). Burning and staining tests (use of Shirlastain). Action of caustic soda and acids.

5. *Production of yarns*

Cleaning the raw fibre, with special reference to wool scouring. Elementary principles of carding, combing, drafting, spinning, doubling and cabling. Main types of yarn: weaving yarns, sewing and embroidery cottons, worsted and woollen yarns, knitting wools. Systems of counting yarns.

6. *Preparation for weaving*

Winding of warp and weft: purposes of different types of package. Sizing of warp and wefts: purposes and materials used.

7. *Weaving*

The essential parts of the plain loom. The work of the weaver and how the weaver is assisted by extra mechanism on the loom: the automatic loom. How patterning is achieved as exemplified by coloured stripes and checks and by simple systems of interlacing. Characteristics of pile fabrics.

8. *Knitting*

Loop formation. The nature and particular uses of knitted fabrics.

9. *Converting "grey" cloth into attractive and useful fabrics*

Bleaching and its effect on the colour and "wettability" of fabrics. Dyeing: the conception of the affinity of dyes for fibres; fastness to washing and light. Printing by blocks, rollers and screens; scope for the artist. Finishing: principles of glazing and smoothing, raising, water-proofing, crease-proofing and shrink-proofing.

10. *Uses of textiles*

Clothing: relative merits of various textile raw materials. Household textiles (bed and table, furnishing, blinds, curtains): their selection and care. Industrial fabrics (tyres, canvas for covers, sails and tents, electrical insulation, filtration).

ADVANCED SUBJECTS

(A 1) GENERAL STUDIES (two papers each of three hours)

Entries for General Studies (Advanced) will be accepted only from:

(a) *internal candidates presented by schools which normally present internal candidates for the examinations of the Joint Matriculation Board,*

(b) *external candidates who are also presenting at the same sitting of the Board's examination two other subjects both at the Advanced level.*

General Studies (Advanced) may not be offered at the same sitting of the examination as the General Paper (Ordinary).

The papers will be designed to test the general studies pursued for at least two years in the sixth form (or to an equivalent stage). It is assumed that the general studies of candidates will vary but that they will include studies in the arts and the natural and social sciences pursued by such means as lessons, discussion, private reading and "out of school" activities. Candidates will be expected to write good English and to be able to read with understanding simple prose in a language other than English. It will be assumed that candidates have studied mathematics or a science or General Science up to Ordinary level and have maintained the study in a more than merely desultory manner beyond this level.

In order to pass in the subject a candidate must satisfy the examiners in each paper separately.

In order to prevent the papers from becoming stereotyped their structure may vary from year to year but they will conform approximately to the following pattern.

Paper I

Comprehension: a passage or passages of English, with questions to test comprehension.

Foreign language: two passages of prose in each of several foreign languages, with questions on them to test understanding. (Passages in Latin, French and German will be provided for all candidates. Passages in Greek, Spanish, Italian and Russian will be provided if application is made on the entry-form. A candidate will be required to attempt two passages in all which may be chosen from one language or from two.)

The arts and the social sciences: one question which may be in "objective" or "essay" form together with a wide choice of "essay" questions. Candidates will be required to answer at least one "essay" question on the arts and one similar question on the social sciences.

Paper II

Questions to test comprehension of scientific or mathematical information presented in tables, figures, diagrams, maps and the like.

Mathematical reasoning: problems involving reasoning and elementary computation.

Science: one from a wide choice of "essay" questions.

Exercises involving the following: composition based on scientific material provided; interpretation of information (verbal, statistical, maps, etc.); solution of problems; the understanding of logical relations and spatial or mechanical relations; tests of general knowledge of science.

Questions on religion and philosophy may be set in either paper.

Optional test in spoken English.

Candidates for General Studies (Advanced) may take an optional test in spoken English; a pass in the optional test will be recorded on the certificate if the candidate reaches the pass standard (Advanced) in the written papers. The test will consist of two parts, Reading and Conversation.

Reading. Candidates will be required to read aloud a prose passage or passages which they have had a few minutes to study. They will be expected to introduce into their reading appropriate phrasing, intonation and flexibility of pace and pause; they will also be required to show their ability to interest listeners and to understand and communicate the mood and content of the passage(s).

Conversation. Conversation may be partly based on the passage(s) used for the test in reading. Candidates will be expected to show their ability to develop a theme in conversation, to introduce their own opinions and to respond to those introduced by the examiner.

The test will be conducted at university and other centres appointed by the Board. A fee of five shillings, additional to the normal subject fee, will be payable for each entry for the optional test.

(A 3) ENGLISH LITERATURE (two papers [Paper I three hours, Paper II two and a half hours] will be set at the Advanced level; a "Special" paper of three hours will also be set)

Advanced Paper I.

(a) Two plays of Shakespeare †.

(b) Questions testing power to understand, appreciate or reproduce the meaning of passages in prose or verse from books not prescribed.

Advanced Paper II. Prescribed books. The paper will be divided into two sections. In Section (1) a question with alternative parts will be set on each prescribed book. Section (2) will consist of three general questions, to be answered from at least one set book and/or other works. Candidates will be required to answer four questions including at least two from Section (1).

Prescribed for 1966

Paper I

Shakespeare, *Hamlet* and **Richard II.*

Paper II

1. Chaucer, Portrait of the Knight from *The Prologue to the Canterbury Tales*; *The Knight's Tale.*

2. *Marlowe, *Edward the Second.*

3. **Metaphysical Poetry, Donne to Butler* (poems of Donne, George Herbert, Crashaw, Vaughan and Marvell), Grierson, Oxford.

4. Milton, *Comus* and *Samson Agonistes.*

5. Pope, *Poetry and Prose*, pages 32—153, Dyson, Oxford.

6. Fielding, *Joseph Andrews.*

7. *Selected Poems of William Blake*, Bateson, Heinemann.

8. Keats, *Poetry and Prose*, pages 34—184, Ellershaw, Oxford.

9. Dickens, *Bleak House.*

10. Ibsen, *The Wild Duck.*

11. Hardy, *The Mayor of Casterbridge.*

12. *Yeats, *Selected Poetry*, pages 49—159, Jeffares, St. Martin's Library, Macmillan.

13. E. M. Forster, *A Passage to India.*

14. Strachey, *Queen Victoria.*

15. *Steinbeck, *The Grapes of Wrath.*

16. W. H. Auden, *A Selection*, pages 77—138, Sections 2 and 3, Hoggart, Hutchinson.

Special Paper.

1. Questions testing power to understand, appreciate or reproduce the meaning of passages in prose and verse from books not prescribed.

2. Questions intended to test the quality of the candidates' appreciation of such books as they have read.

(A 4) HISTORY

Alternative A in Syllabus A may not be offered at the same sitting of the examination as Ancient History and Literature.

Three Advanced syllabuses are available. Candidates may offer **either** Syllabus A (pages 65 and 66, **or** Syllabus B (pages 66 to 68) **or** Syllabus C (pages 68 to 74). Two papers each of three hours will be set on each syllabus. A "Special" paper of three hours will be set on Syllabus A. Candidates offering Syllabus C may take this paper if they wish to do so.

SYLLABUS A

Advanced Paper I. Outlines of **either** Greek and Roman History **or** European History.

Although in Alternatives B and C candidates will be expected to have studied European History with special reference to the main lines of development of the peoples of Western Europe, questions may also be set on the relations of Europe with the rest of the world.

† In setting context questions on the prescribed plays of Shakespeare, the examiner will use the text of the Collins edition by P. Alexander.

* Provided that there is no alteration in the syllabus for the subject, these books will also be prescribed for 1967.

Either

A. Greek History 500—323 B.C. and Roman History 133 B.C.—A.D. 69

Candidates will be required to answer four questions including two on Greek History and two on Roman History.

Or

B. European History 800—1494.

Candidates will be required to answer four questions including at least one from each of the sections (1) 800—1215, (2) 1215—1494.

Or

C. European History 1494—1939.

Candidates will be required to answer four questions including at least one from each of three of the following sections:

- | | |
|---------------|---------------|
| (1) 1494—1648 | (4) 1789—1870 |
| (2) 1648—1715 | (5) 1870—1939 |
| (3) 1715—1789 | |

Advanced Paper II. A period of British History etc.

Either D. British History 1066—1307.

Or E. British History 1307—1485.

Or F. British History 1485—1603.

Or G. British History 1603—1714.

Or H. British History 1714—1815.

Or J. British History 1815—1914.

Or K. British History 1865—1939.

Or L. British Economic History 1700—1914.

Growth and distribution of population. Changes in farming methods and in the agrarian system. Changes in industry, especially textiles, iron and steel and coal-mining. Improvement of transport and communication and its effects. Extension of markets; industrial fluctuations. Development of banking; monetary crises. Expenditure and revenue; tariff policy. Joint-stock organization; limited liability; combination. The co-operative movement. Reform of factory conditions; improvement of public health; development of poor-law. Rise, progress and problems of trade unionism; changes in conditions and standard of living. Main developments in economic and social theory.

Candidates will be expected to have an elementary acquaintance with the main principles of economic theory and also an *outline* knowledge of the political history of the period.

Or M. History of the United States of America from 1783 to the present day.

In each Alternative opportunity will be given to candidates to show knowledge of social history. Though specific questions will not necessarily be set on contemporary literature and authorities, credit will be given to work which shows some acquaintance with the more obvious sources.

SYLLABUS B (British Economic and Social History)

Candidates will be expected to have a knowledge in outline of those topics of economic and social history before 1700 which are relevant to subsequent developments. Similarly reference to events after 1939 will not be considered irrelevant.

The examiners will also assume that candidates possess a knowledge at Ordinary level of the course of British political history since the beginning of the nineteenth century.

I. *British Economic and Social History, 1700—1850.*

1. *Economic and Social Structure before the Industrial Revolution*

Agriculture: its place in the economy; extent of enclosure; agricultural improvement.

Industry: domestic production and organization; its extent in textile and other trades.

Transport: coastal shipping; river navigation; roads.

The rise of the coal industry: the extended use of coal; the extent of large scale industries.

Banking, finance and internal trade: the Bank of England; country banks; the rate of interest; the South Sea Bubble and its results.

Organization of overseas trade: the effects of new trades in colonial produce; economic relations with the colonies; relationship between overseas trade and British Industry.

Society in the first half of the eighteenth century: factors promoting and retarding industrial change.

2. *The Industrial Revolution*

The nature and timing of the Industrial Revolution.

Industrial change: the application of science to industry; textiles, iron and coal; steam power; the rise of the engineering trades.

Factory production: location of industry; increase in industrial output.

Transport: roads; inland navigation; railways; growth of shipping lines and steam navigation.

Overseas trade: changes in direction, volume and organization.

Wars and the economy.

Capital, finance and commercial policy: economic fluctuations; changes in banking; budgetary policy and Free Trade; overseas investment.

Population: growth, movement and concentration.

Classical economists: their teaching on population, rent division of labour, laissez faire.

3. *Agriculture*

Parliamentary enclosure: extent and distribution; connection with rising demand; changes in farming technique, agricultural improvers and writers.

Effects of agricultural changes on rural society: price fluctuations; the Corn Laws.

4. *Social Problems, Reforms and Movements*

Social consequences of the factory system: conditions in towns and factories.

Combinations of employers and employees: early unionism and legislation against it; Owenism; attempts at general unions; the early co-operative movement; working-class political movements and their economic aspects; Chartism.

Reform movements: factories; mines; local government; education; public health; poor relief; government intervention; Utilitarianism.

The churches and social movements.

II. *British Economic and Social History, 1850—1939.*

1. *Industry, commerce and agriculture*

Industrial development: coal; steel; textiles; engineering; shipbuilding.

Transport and trade: Free Trade; expansion of railways; shipping and new markets; growth and extent of overseas trade; overseas investment. Business organization; limited liability; banking and the money market.

Organization of labour: "new model" unionism and the "Junta"; mobility of labour; the co-operative movement; friendly societies.

Social conditions: wages, prices and the standard of living; education; health; housing; poor relief.

Agriculture: high farming; use of machinery; changing techniques in arable and pasture farming.

2. *Britain in the World Economy*

Industry: foreign competition; industrial fluctuations; growth of industrial combination.

Agriculture and its problems after 1875.

Overseas trade: the tariff controversy; home and foreign investment.

Population: growth; migration and emigration.

Organized labour: strikes and lock-outs; "New unionism"; Taff Vale and Osborne judgments; rise of the Labour Party.

Economic and social reforms: workmen's compensation; old age pensions; health and unemployment insurance; emancipation of women.

3. *Britain after 1914*

The First World War and its consequences: boom and depression; return to the gold standard; industrial unrest and the General Strike.

World slump and recovery: protection and imperial preference; problems of coal, steel, cotton, ship-building and transport; the depressed areas; the expansion of consumer goods industries.

Social problems: unemployment and its relief; housing; education.

Agriculture: changes in policy, structure and techniques.

Britain's economic position on the eve of the Second World War.

SYLLABUS C (two papers each of three hours)

Five alternatives will be set of which one only may be offered. In each alternative candidates will be required to take two papers, Paper I on European History and Paper II on a related period of British History. In each paper candidates will be expected to have a background knowledge of events before the beginning of the period. In European History a detailed syllabus is given for each period as a general guide to the subject matter to be studied. The choice of questions will however be such that candidates will not need to cover every topic in the syllabus. In this paper Great Britain will be treated as a European power. Candidates are advised that it is essential to supplement their reading of European History by reference to a good historical atlas. In British History no detailed syllabus is given; in each period, other than in Alternative A, candidates will be given the option of answering a question on documents or other appropriate material prescribed for study. Both papers will be designed to give candidates an opportunity of showing powers of critical argument and logical deduction and examiners will be free to modify from year to year the type of question set to test these powers.

In Paper I (European History), sixteen questions will be set of which four are to be attempted. These questions will call for answers of the "essay" type. In Paper II (British History), Alternatives B to E, candidates will be required to answer a compulsory question based on an extract or extracts from texts other than those prescribed, two questions from eight requiring "essay-type" answers and in addition **either** one further question requiring an "essay-type" answer **or** one question from two to be set on prescribed documents or other appropriate material. In Alternative A, the Reign of Henry III, candidates will be expected to be familiar with the most important documents and of the fourteen questions to be set two will test this knowledge. One of these two questions must be attempted, together with four other questions.

A "Special" paper will not be set on Syllabus C but candidates offering this syllabus may take the "Special" paper set on the existing Syllabus A.

Alternative A

Paper I. European History 1198—1314

The achievement of Innocent III: heresy. The Inquisition.

The Friars. The Fourth Crusade.

Frederick II and the Papacy; the Italian communes.

Innocent IV; centralisation; canon law; the Sicilian Vespers.

France under Louis VIII, Louis IX and Philip the Fair.

The Great Interregnum. Rudolf of Hapsburg; the expansion of Christianity; German colonisation in eastern Europe.

The rise of Universities: Paris, Bologna. Scholasticism. St. Thomas Aquinas. Duns Scotus. Ockham. Dante. Marsilius of Padua. The growth of vernacular literature. Gothic architecture.

Paper II. British History. The Reign of Henry III

A compulsory question on documents or commentaries will **not** be set in this paper, but candidates will be expected to be acquainted with chief original authorities such as the following:

Mathew Paris, *Chronica Major*.

Eccleston, *De adventu fratrum minorum in Angliam*.

Roger Bacon, *Opus Tertium*.

Grosseteste, *Letters (Roberti Grosseteste epistolae)*.

Alternative B*Paper I. European History 1450—1610**The Empire and the Hapsburgs*

The constitution of the Empire; attempts at reform; the growth of the power of the princes at the expense of imperial authority. The Burgundian inheritance. Hapsburg interests in Hungary and Bohemia; Hapsburg-Valois rivalry.

Italy and European politics

The Italian states before 1494. Reasons for foreign interest; French and Spanish invasions; the policies of the Popes; conflict between French and Imperial ambitions and their effects on Italy.

The Renaissance in the fifteenth and sixteenth centuries

General features: interest in classical learning, printing, navigation, the fine arts, patronage, education, mathematics and the natural sciences. Humanism and political thought. The Italian Renaissance. Germany. The Netherlands. England.

The Reformation

The state of the Church. Germany: Luther's career and teachings; the establishment of Protestantism; the Lutheran Church; Anabaptism; the Religious Peace of Augsburg. Switzerland: Zwingli; Calvin and his teachings; Calvinist Geneva. Calvinism in France and the Netherlands. The Reformation in Britain in outline.

The Counter-Reformation

Early reforming movements in Italy. The Church in Spain. Loyola and the Society of Jesus; the Jesuit missions. The Index. The Inquisition. The Council of Trent. The Papacy and reform; assessment of its success.

The growth and consolidation of national monarchies

General features; centralisation and extension of royal power; methods of government; economic and military factors. Spain: Ferdinand and Isabella, Charles V, Philip II. France: Louis XI, Francis I, Henry IV. The Tudors in England. The Vasas in Sweden.

Opposition to centralised authority

The French Wars of Religion and the Revolt of the Netherlands.

Eastern Europe

Russia: development of autocracy and expansion to east and west; relations with the Turks and the Hapsburgs. The Ottoman Turks: the fall of Constantinople; advance on Europe; Suleiman the Magnificent; resistance to the advance of Ottoman power.

Economic and social developments

While candidates will be expected to have an understanding of the economic and social aspects of topics included in the previous sections a more detailed knowledge of the following will be required.

Discovery and colonisation. Trade routes in 1450. The sea route to the East. The New World. Colonial empires of Spain and Portugal. The rivalries of the maritime powers. English and French enterprises. Effects of the discoveries on Europe.

Price rise in the sixteenth century. Organization of trade and industry: money-lending and the rise of banking; trading companies; new industries. Rural society and economy. Evidence of popular discontent.

State regulation of economic and social life.

*Paper II. British History. The Reign of Elizabeth I**Prescribed documents etc.**Ecclesiastical*

Injunctions of 1559.

Act of Supremacy 1559.

Act of Uniformity 1559.

Act against Bulls from Rome 1571.

- Act against reconciliation to Rome 1581.
- Act against Jesuits and Seminarists 1585.
- Act against Popish Recusants 1593.
- Act against Seditious Sectaries 1593.
- Puritan Articles in Convocation 1563.
- Parker's Advertisements 1566.
- Cartwright's Second Admonition 1572.
- Grindal's letter to Elizabeth I about prophesyings 1576.

Constitutional

- Petitions for Privilege 1559 and 1593.
- Wentworth's case 1576.
- Extracts relating to Commons procedure.
- Norfolk Election case 1586.
- Extracts from Smith's *De Republica Anglorum*, Lambarde's *Eirenarcha* with special attention to Parliament, the Council Courts, Star Chamber and Justices of the Peace.
- Commission of the Peace 1590.
- Trial of Mary Queen of Scots 1586.
- Trial of Earl of Essex 1601.

Economic and Social

- Highways Statute 1563.
 - Statute of Labour 1563.
 - Poor Law Acts, 1576, 1598.
 - Monopolies debate 1601.
- (All the above documents may be found in such collections as those of Prothero, Tanner and Elton.)

Alternative C

Paper I. European History 1610—1789

The Thirty Years War

The political and religious divisions in Europe on the eve of the Thirty Years War. Causes of the War and an outline of its course. The Peace of Westphalia and its significance. Condition of central Europe after the War.

Western Europe in the seventeenth century

The establishment of royal absolutism in France. The fortunes of France, Spain and the Netherlands. Rivalry of Bourbon and Hapsburg. The Spanish Succession Question. The Peace of Utrecht and its significance. Constitutional conflicts in England during the seventeenth century. The Revolution of 1688 and the Settlement of 1689—1701.

Northern Europe to the Peace of Nystadt, 1721

Growth of Swedish power under the Vasas. The Northern Wars (1655–60, 1700–21) and their results. Brandenburg-Prussia under Frederick William, the Great Elector. Russia under Peter the Great. Northern Europe at the Peace of Nystadt, 1721.

Europe in the first half of the eighteenth century

European diplomacy, 1714–40. The causes and results of the European Wars between 1733 and 1763. Prussia under Frederick William I. France under Louis XV. The Hanoverian Succession in Great Britain and the rule of the Whigs, 1714–60.

Government in the Age of the Enlightenment

Its principal features. The domestic and foreign policies of Joseph II, Catharine II, Frederick II. Enlightened government in Spain and Portugal. The end of the *ancien régime* in France.

Eastern Europe in the seventeenth and eighteenth centuries

The condition of the Turkish Empire in the early seventeenth century. Rise of Turkish power under the Kiuprilis. Eastern Europe from the Peace of Carlowitz to the Peace of Kutchuk-Kainardji and the Peace of Jassy. The Partitions of Poland.

Religion in Europe, 1610—1789

The settlement of religious issues in the Peace of Westphalia, 1648. Arminianism, Calvinism, Gallicanism, Jansenism. The challenge to religion in the Age of Reason. Deism. Attacks on the Jesuits in Portugal, Spain and France. Toleration. The Church of England and the beginnings of Methodism.

Military and Naval History

Development of armies in the seventeenth century: organization and discipline. Improvements in tactics and weapons by the Swedes and French. "Scientific warfare." Vauban. Tactics in the eighteenth century. The Prussian army. The rise of navies in the seventeenth century; developments during the Anglo-Dutch Wars. The uses and influence of sea-power in eighteenth-century wars.

Economic and Social History

Mercantilism. European economic nationalism as a factor in trading and colonial rivalries. The French economy under Colbert; economic regulation under the *ancien régime*. The Dutch economy: significance of the carrying trade and banking. The Prussian economy under Frederick the Great. Anglo-French commercial and colonial rivalries in the eighteenth century. Economic factors in the American Revolution. Adam Smith, the Physiocrats and criticisms of mercantilism. Financial and commercial organization: joint stock companies, banking, speculation. Improvements in communications in the seventeenth and eighteenth centuries. The agrarian economy and serfdom: agricultural improvements. Growth of population in the eighteenth century. Changes in industry.

European Thought and Culture

Main currents of political thought in the seventeenth and eighteenth centuries: Hobbes, Locke, Montesquieu, Voltaire, Rousseau. The progress of Natural Science: Harvey, Newton, Lavoisier, Priestley. The Physiocrats. Main trends in literature, music, painting and architecture.

*Paper II. British History 1660—1714**Prescribed documents etc.*

An Act to Preserve the Person and Government of the King 1661.

The Corporation Act 1661.

The Act of Uniformity 1662.

Skinner *v.* The East India Company 1666-70.

Bushell's Case 1670.

The Declaration of Indulgence 1672.

The First Test Act 1673.

The Crown and Foreign Policy 1677.

The Second Test Act 1678.

The Impeachment of Danby 1678-79.

The Habeas Corpus Amendment Act 1679.

Proceedings against the City of London 1681-83.

Godden *v.* Hales 1686.

Declaration of Indulgence 1687.

The Seven Bishops' Case 1688.

Invitation to William, Prince of Orange, 1688.

The Mutiny Act 1689.

The Toleration Act 1689.

The Bill of Rights 1689.

Establishment of the Bank of England 1694.

The Act of Settlement 1701.

Act for the Union with Scotland 1706.

Party Government 1706-14.

Impeachment of Henry Sacheverell.

The Occasional Conformity Act 1711.

The Schism Act 1714.

(All the documents prescribed for this paper may be found in Costin and Watson, *The Law and Working of the Constitution*, Volume I, A. and C. Black, 1952.)

Alternative D*Paper I. European History 1789—1870*

A knowledge will be required of the main features of political, economic, social and cultural developments in Europe (including Great Britain); the expansion of British and European influence overseas; the relations of the U.S.A. with Europe. Although for convenience the syllabus is divided into three main sections no such divisions will be maintained in the setting of questions.

POLITICAL HISTORY

(a) 1789—1815

The political, economic, social and intellectual climate in Europe on the eve of the French Revolution. Effects of the Revolution on France and later on other European countries. The rule of Napoleon I in France and the effects of his campaigns on other European states; the invasion of Russia, the Continental System, sea power. (Detailed knowledge of the military aspects of Napoleon's campaigns will not be expected.) The U.S.A. and the European war. Napoleon I's conquest of Spain and Portugal and its effects on Latin America. European (including British) overseas expansion.

(b) 1815—1870

The Peace Settlements of 1814—15. The Concert of Europe. Restoration governments in France. National and liberal movements in Europe before 1848. Russia (including Poland) under Alexander I and Nicholas I. The Eastern Question. The causes and consequences of the Revolutions of 1848. Napoleon III. The unification of Italy and Germany. Political changes in the Hapsburg Empire after 1848. European (including British) overseas expansion.

(c) Military and Naval Studies

Changes in methods of warfare and in the organization and recruitment of armed forces.

ECONOMIC AND SOCIAL HISTORY

A general understanding of the topics listed below will be required. Candidates should also have a knowledge in outline of the agrarian, industrial and commercial features of British and European society in the eighteenth century.

(a) Agriculture and Industry

Reasons for the predominance of agriculture at the opening of the period. Acceptance of the principles of the French Revolution making possible advances towards economic liberation. Industrial and agrarian changes in France, Germany and Russia.

(b) Transport and Communications

Extension of the facilities for transport and means of communication; social and economic effects of these changes.

(c) Commerce and Finance

Changes in taxation after 1789 and trends in European trade. The end of Mercantilism and the rise of laissez faire.

(d) Social History

Causes and effects of the increase in population. Emigration to the U.S.A. and the British Empire. Working class movements.

THE GROWTH OF SCIENCE AND TECHNOLOGY AND DEVELOPMENT OF POLITICAL IDEAS

The principal advances in scientific thought. Political, economic and social ideas in outline.

*Paper II. British History 1815—70**Prescribed documents etc.*

Treaty of Vienna 1815.

Sir N. Conant on the state of the police in London 1816.

The Six Acts 1819.

Castlereagh's State Paper of May 5, 1820.

Prospectus of the Liverpool and Manchester Railroad Co. 1824.

Canning's "New World" Speech 1826.
 Second Report of the Select Committee on Emigration 1827.
 Report... on the Agricultural Disturbances of 1830.
 The Anti-Slavery Society's address of 1830.
 Oastler's evidence on "Yorkshire Slavery" 1832.
 Reform Act of 1832.

(All the above documents may be found in A. Aspinall and E. A. Smith, *English Historical Documents*, Vol. XI (1783—1832) (Eyre and Spottiswoode).)

Poor Law Report of 1834.
 Tamworth Manifesto 1835.
 Attwood's speech on the Charter in 1839.
 From the Committee on Commercial Distress 1847.
 Report on the Board of Health 1848—54.
 Stockmar's view on the place of the Monarchy in the Constitution 1854.
 Gladstone's budget speech of 1860.
 Reform Act of 1867.

(All the above documents may be found in G. M. Young and W. D. Handcock, *English Historical Documents*, Vol. XII (i) (1833—74) (Eyre and Spottiswoode).)

Alternative E

Paper I. Europe and the Modern World, 1870 to the present day

A knowledge will be required of the main features of political, social and economic developments in Europe (including Great Britain); European influence overseas, particularly in the Far East and Africa, and the growth of the U.S.A. Although for convenience the syllabus is divided into three main sections no such divisions will be maintained in the setting of questions.

POLITICAL HISTORY

(a) 1870—1914

The Third Republic in France. The German Empire. The Dual Monarchy of Austria and Hungary. Changes in Russia after 1855. The rise of the U.S.A. and Japan as World Powers. The effects on international relations of European (including British) overseas expansion. The causes of the First World War.

(b) 1914—1939

The First World War: outline of events. The Peace Settlement 1919—23. The League of Nations: organization, achievements and weaknesses. The Russian Revolution of 1917. The revival of Turkey. France between the two World Wars. The Fascist Revolution in Italy. The Weimar Republic. The World Depression and the rise of Hitler. The U.S.S.R. under Lenin and Stalin. The international crises of 1933—39. Origins of the Second World War. Roosevelt and the New Deal. India, China and Japan between the two World Wars.

(c) 1939 to the present day

The Second World War: outline of events. Relations between the Great Powers. The United Nations: organization, achievements and weaknesses. The coming of "the Cold War". The creation of N.A.T.O. and the Warsaw Pact and their consequences. The rise of independent states in former colonial territories.

ECONOMIC AND SOCIAL HISTORY

(a) *Agriculture and Industry*

Increased pace of industrialisation after 1870 with particular reference to Germany, France and the U.S.A. The emancipation of the serfs in Russia. Effects of the two World Wars on the economies of Europe and the U.S.A. Reconstruction after 1919. Economic depression 1929—34 and its consequences. New industries. Planning in the Soviet Union. Aid to under-developed countries.

(b) *Transport and Communications*

Extension of facilities for transport and communication by land, sea and air; social and economic effects of these changes.

(c) *Commerce and Finance*

Trends in world trade and the main changes in commercial policy. Post-1945 movement towards economic unity in Europe. Europe's place after 1945 in the world economy.

(d) *Social History*

Growth and migration of population. The development of State concern with social welfare. Labour movements.

THE GROWTH OF SCIENCE AND TECHNOLOGY AND DEVELOPMENT OF POLITICAL IDEAS

The principal advances in scientific thought. Political, economic and social ideas in outline.

*Paper II British History 1906—1939**Prescribed documents etc.*

Extracts from *They Saw it Happen*, ed. Asa Briggs, Blackwell.

Asquith and Lloyd George pp. 96–101.

The Budget Crisis and the Parliament Act pp. 101–113.

The Outbreak of War, 1914 pp. 171–184.

The End of the Coalition pp. 308–315.

The General Strike of 1926 pp. 379–388.

The Formation of the National Government 1931, pp. 403–417.

The Munich Agreement pp. 466–472.

Documents in *German Diplomatic Documents*, Volume IV, E. T. S. Dugdale, Methuen.

The Agadir Incident, 1911, pp. 1–18.

Documents in *Speeches and Documents on International Affairs*, A. B. Keith, Oxford (World's Classics).

The Peace Settlement of 1919.

The Fourteen Points; the Covenant of the League of Nations; the territorial, military and economic settlement (Vol. I, pp. 1–61).

Reparations and War Debts 1931–34 (Vol. I, pp. 232–255).

Baldwin's speech on 14 November 1936 (Vol. II, pp. 175–181).

Documents in *The Gathering Storm* (Volume I of the Second World War Memoirs), W. S. Churchill, Cassell.

Churchill's statement to the Press of 21 September 1938, p. 238 **and subsequent events, pp. 263–265.**

Special Paper.

The paper will be divided into two sections, Section (1) covering the periods of Alternatives A, B and C, Section (2) the periods of Alternatives D, E, F, G, H, J, K, L and M in Syllabus A at the Advanced level. Each section will also contain three optional questions of a general historical nature. Candidates will be required to answer four questions, two from each section. Candidates offering Advanced Syllabus C may take this paper if they wish to do so.

The examiners will be instructed to pay particular attention to the style and arrangement of answers and to give credit for acquaintance with original sources.

(A 5) ANCIENT HISTORY AND LITERATURE (two papers each of three hours)

Candidates will be expected to have studied in the original at least four of the eight texts prescribed for Greek (Advanced) and Latin (Advanced), preferably two Greek and two Latin.

Paper I

1. Questions on Greek History, including social history. Candidates may offer **either** Greek History 600 B.C.—404 B.C. **or** Greek History 500 B.C.—323 B.C. Ten questions will be set of which candidates will be required to answer three.

2. Questions on the prescribed books for Greek (Advanced) (page 87) and on topics selected at the examiners' discretion from the following list: Epic, History, Drama, Oratory. **Two questions** will be set on each of the four prescribed books and there will be two questions on other topics. Candidates will be required to answer two questions from this part of the paper.

Paper II

1. Questions on Roman History, including social history. Candidates may offer **either** Roman History 290—44 B.C. or Roman History 133 B.C.—A.D. 69. Ten questions will be set of which candidates will be required to answer three.

2. Questions on the prescribed books for Latin (Advanced) (page 87) and on topics selected at the examiners' discretion from the following list: History, Oratory, Satire, Letter-writing. **Two questions** will be set on each of the four prescribed books and there will be two questions on other topics. Candidates will be required to answer two questions from this part of the paper.

(A 6) BRITISH GOVERNMENT (two papers each of three hours)

The examiners will assume that candidates possess a knowledge at Ordinary level of the course of British history since the beginning of the nineteenth century and they will be at liberty to set questions which involve such a knowledge.

The nature of the constitution. Law and convention. The principle of "separation of powers". Parliamentary sovereignty and popular sovereignty. Representation and responsibility. The rights of citizens. The ideas of efficiency and economy in government.

Parliament. The powers of Parliament. Relations between the Houses. Parliamentary privilege and procedure. Delegated legislation. The role of the monarch.

Representation. The electoral system. The organization of political parties and their place in government.

Cabinet government. Privy Council and Cabinet. The office of Prime Minister. The work of the Cabinet in relation to Parliament and to administration.

Central administration. The Departments of State. The Civil Service. Public corporations and other administrative bodies.

Local government in England and Wales. Structure and functions of local government. The organization and finance of local authorities and their relations with the central government.

The judicial system in England and Wales. The system of courts. Civil liberties. Judicial control of public authorities. The organization and functions of the police.

(A 7) GEOGRAPHY (two papers each of three hours will be set at the Advanced level; a "Special" paper of three hours will also be set.)

Candidates will be expected, wherever possible, to show in their answers that they have made personal observations in the field on the subjects they are discussing.

Simple sketch maps and diagrams should be given wherever relevant.

Advanced Paper I. General geography.

The paper will be divided into three sections, A, B, C. Three questions will be set in each of Sections A and B and six in Section C. Candidates will be required to attempt one question from each of Sections A and B and two from Section C.

Candidates will be expected to utilize their knowledge of the geography of the British Isles in answering questions on this paper.

A. The chief types of landform and their development. The surface characteristics of the major land masses and of their main structural units.

B. The factors determining climate including an elementary knowledge of the physical processes involved. Distribution of temperature, pressure, surface winds and precipitation. The use of these elements as a basis for distinguishing major climatic regions. The characteristics and distribution of the major types of natural vegetation. An elementary knowledge of soils.

C. The factors affecting distribution and density of population and patterns of settlement. Major types of economy. The principal factors affecting the production of major foodstuffs and raw materials, the exploitation of mineral wealth and sources of power, and the distribution of manufacturing industries.

Advanced Paper II. Regional geography including mapwork.

The paper will be divided into three sections, A, B, C. Candidates will be required to answer Section A together with three other questions including at least one from each of Sections B and C. Candidates will be advised to spend not more than 45 minutes on Section A. Five questions will be set on each of the regions prescribed for Sections B and C.

A. The study of the geography of small regions by the use and interpretation of topographical maps (especially the 1:63,360 and 1:25,000 Ordnance Survey maps) and by the use of photographs. The field study of rural and urban areas.

B. The regional geography of **one** of the following:

1. West Germany, Norway, Sweden and Denmark.
2. France, Belgium, Luxemburg and the Netherlands.
3. Italy, Switzerland and Austria.

C. The regional geography of **one** of the following:

1. The U.S.A. and Canada.
2. Latin America (including the West Indies).
3. Africa.
4. India, Pakistan and Ceylon.
5. Australia, New Zealand and the East Indies.
6. The U.S.S.R.
7. China and Japan.

Questions set on the areas of continental proportions in Section C will be on a broader basis than the questions in Section B.

Special Paper.

Questions of a more searching character will be set on the syllabus at Advanced level.

(A 8) ECONOMICS (two papers each of three hours will be set at the Advanced level; a "Special" paper of three hours will also be set)

Economics may not be offered at the same sitting of the examination as Commerce.

The syllabus does not contain direct references to economic history or to the development of economic thought but candidates should have some general knowledge of these fields.

Advanced Paper I. Principles of Economics.

1. The central problems of economic societies. Scarcity, choice and the allocation of resources.

2. The concept of the national income; its measurement and composition.

3. The factors of production: land, labour, capital; the stock of accumulated knowledge. The role of enterprise. Division of labour. The causes of location of industry. Laws of returns. Population. The factors determining average income per head.

4. The allocation of resources in a free and in a planned economy. An outline of the functions of the price mechanism. The causes and effects of changes in the demand for and supply of goods and of factors of production. The theory of consumers' behaviour. Demand, elasticity of demand. Increasing and diminishing costs. Cost and revenue curves of the firm. Supply and the supply curve of a competitive industry, elasticity of supply. Determination of prices under competition, imperfect competition and monopoly. The incidence of direct and indirect taxes.

5. Distribution of income: wages, interests, profits and rent.

6. The nature and functions of money. The banking system and the supply of money. Changes in the value of money (price levels) and methods of measuring them. The causes of changes in the price level.

7. The nature of international trade. The theory of comparative costs. The theory of international payments; variable and fixed foreign exchange rates.

8. The general level of employment.

Advanced Paper II. The economic structure of Great Britain.

1. Industrial structure. Large and small firms; specialization among firms; private and public enterprise.

2. The location, organization and problems of the following industries: coal, iron and steel, cotton textiles, road and rail transport, motor vehicles, agriculture. Retail trade and distribution.

3. The labour market, its size and the sex distribution and age distribution of the population. Geographical and occupational distribution and mobility of labour. Trade unions, employers' organizations and collective bargaining.

4. The role of government; public finance; economic and financial problems of the social services; central and local government revenue and expenditure.

5. The functions of the commercial banks and of the Bank of England; the organization of the money and capital markets; the Stock Exchange.

6. The structure and composition of Britain's balance of payments and balance of trade. The terms of trade. The foreign exchange market.

Special Paper

Questions of a more searching character will be set on the syllabus at the Advanced level.

(A 10) BOOK-KEEPING AND ACCOUNTING (two papers each of three hours)

1. *Principles of book-keeping and accounting.* Advantages; meaning of double-entry; the ledger; classes of ledger account; trial balance; preparation and function of profit and loss account and balance sheet.

2. *Practical aspects of book-keeping.* Development of original books of entry; transfer journal; day books—purchases, sales and returns; columnar day books; three-column and two-column cash books; petty cash and the imprest system; bank reconciliation statements; subsidiary records for bills of exchange (in outline only).

3. *Preparation of revenue account and balance sheet in detail.* Function of manufacturing, trading, profit and loss and appropriation sections of the "Final Account"; final accounting adjustments with reference to prepayments, items accrued, depreciation and provision for bad debts and discounts; profit and loss account and balance sheet of sole trader; receipts and payments account and its defects; income and expenditure account based on double-entry.

4. *Partnership accounts.* The main provisions of the Partnership Acts; use of appropriation account and current accounts; goodwill; admission of a new partner; retirement or death of a partner; dissolution, sale of a business.

5. *Application to special types of transaction.* Manufacturing accounts; estimated trading accounts for stock valuations and fire claims; columnar book-keeping; departmental accounts; percentage trading and profit and loss accounts; self-balancing ledger and (total) control accounts; consignments; hire purchase and instalment payment accounts; simple branch accounts; investment accounts; incomplete records and conversion to double-entry.

6. *Company accounts.* Types of capital and shares; issue of shares; classes of debenture and their issue and redemption; function of appropriation accounts in company accounting; provisions and reserves; preparation of profit and loss account and balance sheet in accordance with Companies Act, 1948; purchase of a business; simple amalgamation and absorption.

7. *Interpretation of accounts.* Use of percentages and other elementary statistical devices; use of comparative figures; rate of turnover and its significance; the relationship of gross profit to sales; working capital; net worth; use of balance sheet grouping to facilitate interpretation.

8. *Costing.* The general principles of cost and stores accounting and their practical application.

(A 11) SCRIPTURE KNOWLEDGE (two papers each of three hours will be set at the Advanced level; a "Special" paper of three hours will also be set.)*

Advanced Paper I. Old Testament

An outline study of the history, literature and thought of a prescribed period as illustrated by the passages specified. The paper will include questions which involve a general knowledge of (i) the history not included in the Old Testament, (ii) the discoveries of archaeological records which are relevant to this history.

Either

A. The making of the nation.

The primitive Hebrew traditions of the Creation, the Fall of man, the Flood and the Patriarchal Age, the sojourn in Egypt, the Exodus and the conquest of Canaan; the light thrown on these traditions by modern scholarship, particularly that relating to the contemporary history of the nations with whom the Hebrews were in contact. A general knowledge of the textual sources of the Pentateuch with their characteristics and approximate dates. Religious beliefs and customs in their gradual development from primitive days; Moses and his work; the effect of the settlement in Canaan on Hebrew life and religion; tribal life to the time of the confederation and the accession of Saul.

Genesis i—iv 15, vi 9—ix 17, xi 27—xviii 33, xxi—xxxiii, xxxv 1—20, xxxvii, xxxix—xlvi 6, xlvi 26—1 26; Exodus i—xx, xxxii—xxxiv; Numbers xi—xiv, xvi, xx—xxiv; Joshua i—xi; Judges i—xvi; I Samuel i—vii.

Or

B. Kings and prophets.

The course of national history under the kings; the division of the kingdom; the building of the Temple and the increasing religious importance of Jerusalem; the rise of the prophets, with some understanding of their nature and function; the Deuteronomic reformation; the writing prophets, from Amos to Ezekiel and the Second Isaiah; the tension between prophetic and priestly religion. The growth of the great Eastern Empires and the decline of Egypt, leading to the conquest of Samaria and the captivity of the northern tribes, and finally to the destruction of the Temple and the Babylonian captivity of Judah. The lives and teaching of the greater prophets. The course of the Exile gathered from the available records: Scribes and the writing of the law; Synagogue worship; Psalmists; the Sabbath and Circumcision. The events leading to the Return.

I Samuel viii—end; II Samuel; I Kings i—v, viii—end; II Kings; Deuteronomy i 1—18, iv 1—40, viii, xii 1—28, xvi, xviii 1—8, xxxii, xxxiii; Amos; Hosea; Isaiah i—iii, v—xii, xxix—xxxii, xxxv—xlv, xlix, l 4—9, lii 13—lv; Micah i—iii, vi; Jeremiah i, v—ix, xvii, xviii, xx—xxiii 8, xxiv, xxvi, xxviii, xxix, xxxi—xxxiii, xxxvi—xliii 7; Ezekiel i—vii, xiv, xviii, xxiv, xxxiii, xxxiv, xxxvi, xxxvii, Psalms xlii, xliii, cxxxvii.

Or

C. The rebirth of the nation.

The causes and stages of the Return; the Persian supremacy; the prophetic work of Haggai and Zechariah; the political and religious work of Nehemiah and Ezra; the significance of the books of Jonah and Ruth; the conquests of Alexander; the Hellenistic kingdom; the character and policy of Antiochus III; the Maccabean revolt, its course and consequences; the Apocalyptic writing—Daniel; the wisdom literature; high priestly government; the rise of the Pharisees; the Roman conquest; Palestine as a subject kingdom under the Herodian dynasty.

Ezra i, iii—vii, viii 15—x 17; Nehemiah i—vii 5, viii, ix, x 28—xi 2, xii 27—xiii; I Maccabees; Haggai; Zechariah i—viii; Isaiah **lvi—lxvi**; Jonah; Ruth; Daniel i—vii, x—xii; Malachi iii, iv; Job i—xxiv, xxix—xxxii, xxxviii—xl 5, xlii; Psalms xlv, l, li, lx, lxxiii, lxxiv, lxxix, cx, cxx—cxxxiv; Wisdom i—iii 9, v, vii 15—viii 1; Ecclesiasticus *Prologue* and i 1—20, xxiv, cxxviii, xlv 1—15, l.

* The text used by the examiners will be that of the Revised Version. Papers using the Douai Version and the Knox Version of the Old and New Testaments will however be set each year in all alternatives without notice being given. No extra fee will be charged.

*Advanced Paper II. New Testament***Either**

A. The life and teaching of Our Lord as recorded in the Gospels.

A general knowledge of the introduction to, and contents of, the four gospels will be required together with a special study of one gospel.

Prescribed for 1966

The Gospel according to St. John.

Or

B. The origin and growth and the life and thought of the church in the first century.

1. The main events in the lives of the leaders of the early Christian church as recorded in the Acts of the Apostles. The main events in the churches in the chief centres of missionary activity as recorded in the Acts of the Apostles and in the epistles, together with some knowledge (from extra-Biblical sources) of life and customs in those centres.

2. Jewish and Gentile Christianity. The differences between these interpretations as illustrated by Stephen's speech (Acts vi 8—vii 53), Peter's vision (Acts x), the Pauline controversy (Acts xv 1—29, xxi 15—36 and Galatians) and by a general comparison of the gospels of St. Matthew and St. Luke.

3. Persecution of the Church in the first century. Causes of persecution by Jews and by Romans. The chief Roman persecutions. Differing attitudes of Christians towards Roman authority. Hebrews x 32—xii 29 with reference to the argument leading to these chapters: i 1—4, ii 1—4, iii 1—14, iv 14—16, vii 25—28, ix 11—14; I Peter. Revelation i—vi, xi—xiii, xvii, xviii, xxi, xxii.

4. Letter writing in the early church. Letters as a bond of unity amongst the churches. Some characteristic purposes of the letters. A special study of Philippians, Colossians and I John to illustrate these purposes.

5. The Christian way of life. A general knowledge of its chief features as described in characteristic passages in the epistles of the New Testament.

Questions involving the translation of and comment upon prescribed passages of the Greek text of the New Testament will be set if application is made by **1 December** preceding the examination; details of the passages prescribed for this purpose may be obtained on application to the Secretary. No extra fee will be charged.

Or

C. Aspects of the history of the Christian Church.

Either (a)

1. *The transmission of the Bible*

The formation of the Gospel tradition; the ancient manuscripts of the Bible; the formation of the Canon of the Bible; Jerome's Vulgate; Anglo-Saxon Versions; the place of the monastery in the transmission of the scriptures; the Carolingian Renaissance and Alcuin's Bible; the Bible and the Reformers; the history of the English Bible to 1611; Geneva and Rheims-Douai Versions; from the Revised Version to modern translations. The place of the arts in the transmission of the Bible and of Biblical knowledge.

2. *The Church and the Churches*

The Church in the New Testament and up to the Edict of Constantine; Christendom after A.D. 313: Eastern and Western Christendom; reform movements in Western Christendom: Lutheran and Reformed Churches, the Church of England; the rise of the Separatist sects in England; causes and nature of main divisions: Baptist, Presbyterian, Congregationalist; the Methodist Movement. The Oecumenical Movement and some unions and attempted reunions.

Or (b)

Candidates choosing this alternative must answer questions (1) from either Section (i) or Section (ii) and (2) from either Section (iii) or Section (iv)

(i) *The Church in Anglo-Saxon England*

The Christian Church in Roman Britain; the rise and development of the Celtic Church; the Augustinian Mission; the development of Monasticism; Theodore, Wilfrid and the Church

of the seventh century; the effect of the Danish invasions on the English Church; the developing organization of the Church in later Anglo-Saxon England.

A knowledge of Christian literature, art and architecture during the period will be expected.

(ii) *The Reformation and its aftermath in England*

The condition of the Church on the eve of the Reformation; problems of the relationships between Church and State; the development of the Reformation in England (some general knowledge of trends in the Continental Reformation will be expected); the rise and development of Separatism; crises in the Church of England from 1603 to 1663.

(iii) *The mission and expansion of the Church*

The missions following the trade routes in the thirteenth century, especially the Franciscan Missions; the Jesuit Missions of the sixteenth and seventeenth centuries; the trading companies in India and the subsequent development of missions in India from the seventeenth century; the colonization of America and missions to the Indians in the seventeenth century; the opening up of Africa and the growth of missions in the nineteenth century; missions in the twentieth century and the World Church. Opportunity will be given for candidates to show a knowledge of the biographies of some leading figures in these movements.

(iv) *Movements in the English Church from the eighteenth to the twentieth century*

The social and political background in the later eighteenth century; the leading movements in English religious life in the later eighteenth and the nineteenth centuries: the Evangelical Revival, the Oxford Movement, the Christian Socialist Movement, the Liberal Movement, developments in the Roman Catholic Church; twentieth-century trends: the developing Oecumenical Movement; Prayer Book revision; new Bible translations; attempts and conversations concerning Church Unity.

(A 12) ART

Art (Advanced) Paper III may not be offered at the same sitting of the examination as any of the following: Craft (Design and Practice), Alternative J (Dress) (Ordinary or Advanced); Woodwork (Ordinary or Advanced); Housecraft (Advanced); Needlework and Dressmaking (Advanced).

Four papers, each of three hours, will be set; any combination of three may be offered.

A "Special" paper of three hours will also be set.

In Papers I and II media and method of working will be left to the candidate's choice. If oils are to be used, notice must be given by 1 May of the year of examination. For Papers I and II either half-imperial paper (white or tinted) or canvas or board is to be used as supplied by the centre. The paper or canvas or board may be cut to any proportion but the maximum size must not exceed 22 in. by 15 in. Special answer-books will be supplied by the Board for Papers III and IV.

Advanced Paper I. Pictorial or graphic aspects of art.

Candidates will be required to execute **one** of the following:

- (a) A figurative composition on one of several set subjects.
- (b) A non-figurative or an abstract composition on a single set theme.

Candidates offering Paper I will be informed, twenty-one days before the date for working the paper, of the prescribed subjects or themes on which questions will be based. They will be required to bring to the examination room preliminary studies made by them during this period in preparation for the paper. Two pages of these preliminary studies (which may be pages extracted from a sketch-book) will be forwarded to the examiner together with the work done in the examination room; these pages will not be returned to the candidates.

In the examination room candidates will be free to refer to their preliminary studies and also to their sketch-books.

Advanced Paper II. A study or studies showing direct and analytical observation of, and response to, one of the following:

- (a) Objects arranged in a composition by the candidate.
- (b) The living model in everyday costume.

(c) Natural forms.

(d) A manufactured article.

A candidate offering Paper II (a) will be allowed thirty minutes immediately before the period allowed for working the paper to select one or more of the objects provided and to arrange them for use in his composition.

Advanced Paper III

The arts of daily life.

Candidates will be required to answer questions from at least two sections, one of which must be Section (1).

Most questions will be concerned with dress and furniture, especially as reflections of aesthetic developments in Britain after the Norman Conquest. This will not preclude reference in questions or answers to achievements of direct relevance in other countries or periods. Throughout the paper, and particularly in Section (1), certain questions will require a knowledge of related arts and developments in design, and credit will always be given for evidence of first-hand study. Where such knowledge is not specifically required, candidates will nevertheless receive credit for apposite reference outside the specialized fields of furniture and dress.

Advanced Paper IV

Either

(a) History and appreciation of architecture and the allied arts.

The paper will consist of five sections, Section (1) the general history of architecture in England, and Sections (2) to (5) each of which will cover in more detail a limited period of historical development. Candidates will be required to answer two questions from Section (1) and two from the remainder of the paper.

In each section the following will be required:

A broad understanding of how the principal styles of architecture grew from social, economic, political, technical, climatic, geographical, geological and other considerations. Some knowledge of construction, materials and structural principles, and of general planning, together with the principles of internal and external decoration relative to the period. Wherever possible actual examples of architecture should be studied. Sketch perspectives, plans, diagrams and other forms of illustration may be required.

Section (1)

English architecture from Norman times to the present day.

Section (2)

Classical architecture

Greek architecture from the seventh to the fourth century B.C. and Roman architecture from the first to the fourth century A.D. Candidates will be expected to have some knowledge of antecedents in Mycenae and Crete and the Beginnings of Early Christian architecture in Rome.

Section (3)

Medieval architecture

Architecture in France c. 1000—1500 and in England c. 1000—1600.

Section (4)

Renaissance architecture

Architecture in Italy c. 1400—1700 and in England c. 1600—1800. Some knowledge of the more notable architects and their individual contributions will be expected.

Section (5)

The architecture of the Modern Movement

The period from the early development of cast iron construction to the present day. While questions will be set primarily on English architecture, some knowledge may be required of outstanding work by architects in France, Germany, Scandinavia, Italy and the Americas.

Or

(b) History and appreciation of painting.

Candidates will be required to answer questions from at least two sections, one of which must be Section (1).

Questions will be mainly concerned with developments and painters within the prescribed periods, but this will not preclude reference in questions or answers to artists or developments of direct relevance in the immediately preceding or succeeding years. Candidates will receive credit throughout the paper for apposite reference to arts other than painting.

Where a sub-section refers to more than one country inter-relationships may be of particular importance.

Prescribed for 1966

Section (1)

- (a) General Appreciation.
- (b) Painting in Europe 1900 to the present day.

Section (2)

- (a) Painting in Florence and the Netherlands 1400—1500.
- (b) Painting in Italy 1500—1600.
- (c) Painting in Italy 1600—1700.

Section (3)

- (a) Painting in France, Venice and England 1700—1800.
- (b) Painting in France and England 1800—1900.
- (c) Painting in the Low Countries 1600—1700.

Special Paper

The paper will consist of questions on criticism and on the principles and history of Art and Architecture. Every candidate attempting the paper will be required to submit not less than three and not more than six half-imperial mounts of work selected from his course work. (If the original of any course work is too large to be mounted on a half-imperial mount, or is in three dimensions, photographs may be submitted.)

In order to qualify for the award of "distinction" or "merit" a candidate will be required to satisfy the examiners both in the written paper and in the course work submitted.

Each mount must bear a certification of authenticity signed by the Head of the school or, in the case of an external candidate, by the Principal of a school or college of art or other appropriate institution. The mounts will not be returned to candidates.

(A 13) CRAFT (DESIGN AND PRACTICE) (one paper of three hours and a practical examination)

Alternatives H and J may not be offered at the same sitting of the examination as Needlework and Dressmaking (Advanced).

Alternative J may not be offered at the same sitting of the examination as either Syllabus B or Syllabus C in Domestic Science (Ordinary) or Paper III in Art (Advanced).

Nine alternatives will be set each year. Candidates may offer one, and only one, of the alternatives.

A. LETTERING, WRITING AND ILLUMINATION

History

The development of the letter from early times; the written letter; the printed letter; modern versions of old types; contemporary design of letters.

Methods

Tools, materials and processes. Wood, stone, metal, vellum, parchment, paper; the qualities of different materials and their proper use; preparation for use; tools and their appropriate use for different processes and purposes; the influence of tools and materials on the character of letters; preparation of designs; proportions of letters, margins and spacing.

Practical Examination (six hours)

The candidate will be expected to prepare alternative sketch-designs, part or the whole of one of which is to be carried out in the materials and tools of the chosen craft: pen or

brush lettering on paper or wood; letter cutting in stone or wood; engraving on metal. As much of the design as time allows is to be completed and at least sufficient to give an idea of the completed effect and to show the right use of materials and tools.

B. STAGE DÉCOR AND COSTUME

History

Candidates will be expected to show a general understanding of the main characteristics of Greek, Roman, Elizabethan and Restoration stage décor and costume and also a knowledge of its development up to the present day.

Methods

Stage forms, open and enclosed. Lighting, internal and external to stage. Types of construction of characteristic settings; materials. Construction of flats and properties. Visual angles, masking, borders. Stage dress; materials in common use.

Practical Examination (six hours)

Either

1. Design for a stage setting using stage plan, diagrams and colour elevations.

Or

2. Design for costumes and accessories.

Questions will be based on designs for a play. The two plays prescribed for this purpose will be announced on or about 1 April each year. Questions will be set on only *one* of these plays and candidates will be required to answer one question on the play selected by the examiners. They will also be required to submit to the examiners at the time of the practical examination their notebooks containing designs and other studies based on both plays.

C. PICTORIAL CRAFTS

History

The development of the pictorial crafts; prehistoric drawing, painting and incised work; the wood-cut; wood engraving; engraving in metal; lithography and the printing processes (line, half-tone and colour blocks, screen printing).

Methods

Tools, materials and processes; a general appreciation of the qualities of the materials and the purposes for which they may be properly used; tools for engraving; inks, chalks, papers; standard paper sizes; types of printing presses, other reproductive equipment and methods of use.

Practical Examination (six hours)

The candidate will be expected to prepare alternative sketch-designs one of which is to be carried out in the materials and tools of the chosen craft: lithography, lino cut or wood engraving. As much of the design as time allows is to be completed and at least sufficient to give an idea of the completed effect and to show the right use of materials and tools.

D. POTTERY

History

An outline of the history of English pottery; an appreciation of the traditions of the main cultures in which pottery was especially significant, e.g. China, Egypt and Greece, together with some knowledge of European developments as they affected the work of English potters.

Methods

Bodies and glazes; nature and characteristics. Hand method of making pots; thrown, moulded and coiled forms. Methods of decoration. Firing; behaviour of bodies and glazes. Tools and implements in common use. Simple plaster moulds; various types of potter's wheels; general knowledge of factory methods.

Practical Examination (eight and a half hours)

Sketch suggestions and execution of pots by coiling, slabbing or throwing, with or without handles and spouts; decoration by the main traditional methods; grinding, preparation and application of glazes.

E. MODELLING AND CARVING

History

Candidates will be expected to show a general understanding of the main characteristics of Egyptian, Greek, Roman, Medieval and Renaissance sculpture and also a knowledge of the development of English sculpture up to the present day based as far as possible on the study of actual examples.

Methods

Nature and use of materials: various kinds of wood and stone, clay, plaster, concrete and metals. Tools and equipment. Armatures. Surface treatments: polishes and colouring.

Practical Examination (six hours)

Candidates will be given a choice of subjects such as the following: a figure or group of figures, an animal, a head, an abstract subject, a short inscription in Roman letters and numerals.

The work may be executed either in the round or in relief, modelled in clay or cut in wood, stone or plaster, and candidates will be expected to complete either a portion or the whole of the design. Work may be submitted in the form of fired clay or plaster casts. If the latter is employed casting will not be assessed and assistance in casting may therefore be given to the candidates if required.

F. WEAVING

History

An outline of the history of weaving in the British Isles to the present day, including tapestry, silk, tweeds, dress and furnishing textiles, excluding carpets. A brief survey of the work of those foreign centres which at any particular time influenced British styles or methods.

Methods

Natural and synthetic fibres, their origins and uses: silk, wool, cotton, flax, man-made fibres. Spinning, doubling, fancy yarns. Yarn counts: assessment of quantities. The hand loom and its parts (not exceeding eight shafts and two beams). Principles of dobby and Jacquard weaving. Warping, beaming, denting. Drafting for four shafts. Finishing. Basic types of rug weaving.

Practical Examination (six hours)

The candidate will be expected to prepare sketch-designs in any medium on half-imperial paper. Designs are to be executed and developed on a prepared warp. As much of the design as time allows is to be completed and at least sufficient to give an idea of the completed effect and to show the correct use of materials and equipment.

G. FABRIC PRINTING

History

Fabric printing in Europe up to 1815 and in England up to the present day.

Methods

Methods of printing—hand processes, block, screen, machine. Registration. Styles of printing: direct, discharge, resist. Preparation of printing media: blocks, screens, rollers. Dyestuffs: preparation, application and after-treatment. Types of repeat: relationship of repeat to cloth width, process of printing and purpose.

Practical Examination (six hours)

The candidate will be expected to prepare sketch-designs, using up to four colours, for dress or furnishing prints. Blocks or screens are to be prepared and printed, sufficient of the design being completed to give an idea of the completed effect and to show the correct use of materials and equipment.

H. EMBROIDERY

History

An outline of the history of **either** English ecclesiastical embroidery **or** English domestic and costume embroidery of the sixteenth, seventeenth and eighteenth centuries. The development of embroidery in the twentieth century and its contemporary trends.

Methods

Ground materials etc., threads; silk, wool, cotton, linen, rayon: characteristic qualities and different varieties; jewels, sequins etc. Tassels, fringes, insertions, edge treatments. Stitches of different types, e.g. chain, knot and flat stitches, canvas stitches. The relation of stitch to thread used. Frames and other equipment. Mounting and framing of pictorial embroidery and making up of three-dimensional objects (e.g. tea-cosies, evening bags).

Practical Examination (eight hours)

Design and execution of samples of embroidery.

J. DRESS

History

An outline of the history of English women's dress.

Methods

Measurements for basic dress patterns, bodice, sleeve, skirt; British and American standards. Pattern cutting for all parts of basic dress types. Lay-out of patterns on various widths of cloth, bodices, skirts (pleated, panelled and flared), sleeves, "princess" line and one-piece dresses. Fabrics, natural and synthetic: characteristics and behaviour in wear and washing. Seams and finishes; stiffenings and interlinings. Assembly by hand and machine. Pressing. Use of accessories: shoes, bags, hats, gloves, scarves, jewellery, belts.

Practical Examination (six hours)

The candidate will be expected to prepare sketch-designs for a garment or garments, including lingerie, to employ blocks, cut patterns and make full scale pressed toiles of specified parts of the garment. As much of the design as time allows is to be completed and at least sufficient to give an idea of the completed effect and to show the right use of materials and equipment.

(A 14) MUSIC (two papers each of three hours and a practical examination will be set at the Advanced level; a "Special" paper of three hours will also be set)

Credit will be given for good musical handwriting.

*Advanced Paper I.*1. *Four-part harmonic writing for voices*

All diatonic chords. Unessential notes (diatonic and chromatic) including appoggiaturas and suspensions. Modulation to the five most nearly related keys. (To be tested by the harmonization of a melody or a bass, at the discretion of the examiner.)

2. *Harmonic analysis*

The recognition and naming of any diatonic chords and the more usual chromatic chords, in a passage for voices or piano, which may include modulation to any related or unrelated key.

3. *Two-part contrapuntal writing*

The addition of a violin part to a cello part or *vice versa* at the discretion of the examiner, based on the requirements shown under 1. above.

4. *Melodic writing*

The completion of a melody in a given dance form and its harmonization by the addition of a simple accompaniment for piano or for violin, viola and cello, at the discretion of the examiner.

*Advanced Paper II.*1. *Musical History*

A general survey of the main trends of musical history from 1550 to the present day with special reference to (a) one of three prescribed periods, (b) one of five special topics. A general knowledge of the chief musical forms and a real acquaintance with standard works will be required. A choice of questions will be given.

2. Prescribed works

(a) A critical study of a prescribed work in relation to its form, construction and musical content. A copy of this work must be brought to the examination room by each candidate. It must be free from marks or annotations except for the numbering of bars; all notes, analyses, advertising matter etc. which may be included in it must be removed or efficiently obscured. The numbering of bars is to begin with the first *complete* bar of each movement and where there is a repeat with "first time" and "second time" bars, those bars are to be numbered with corresponding numbers, e.g. 59a, 59b.

(b) A critical study of a prescribed work in relation to its form and construction and the period in which it was written. No reference to the score of this work will be permitted during the examination.

Prescribed for 1966

1. Prescribed period: 1700—1830.
2. Special topic: The Opera 1820—1960.
3. Compulsory work, for detailed study:
Mozart, Quartet in C major, K.465.
4. **One** of the following works for more general study:
Sibelius, *Lemminkäinen's Return*, Miniature Score, British & Continental Music Agencies Ltd.
Holst, Choral Hymns from the *Rig Veda* (Third Group only), Stainer & Bell Ltd. (No. 1214).

For Paper II candidates are to bring to the examination room copies of Mozart's Quartet in C major.

Practical Examination

Tests in sight singing and dictation may contain chromatic notes and modulation to the five most nearly related keys, except for the four-part dictation test, which will not modulate.

1. Sight singing

A sixteen-bar melody. The tonic chord will be sounded by the examiner.

2. Dictation

Each dictation test will be played straight through once, then twice in sections, then straight through twice, with an interval of at least half a minute before each repetition. The key will be named by the examiner and the tonic chord sounded, with the tonic at the top, whenever a test is played from the beginning.

(a) Melody

Not more than twelve bars, of reasonable difficulty.

(b) Two-part counterpoint

Four bars, of reasonable difficulty.

(c) Four-part harmony

Four bars. Candidates will be required to write down the melody and bass and to name the chords. The chords can be any of those specified under I. 1. above.

3. Recognition of modulations

Three short passages will be played by the examiner, each beginning similarly and modulating to one of the five most nearly related keys. Candidates will be told the original key and will be expected to write down the name of the key to which the passage has modulated. Each passage will be played twice.

4. Viva voce

This test is designed to test the candidates' general musical interests and aptitudes.

Candidates will be asked (a) to play a piece of their own choice on the piano or on any instrument they choose to bring with them to the examination, or if they prefer, to play at sight a pianoforte piece provided by the examiner, (b) to demonstrate their practical musicianship at the keyboard, in accordance with the requirements of the examiner, by

playing cadences, harmonizing a melody or by very simple transposition or improvisation, (c) to discuss their music-making and concert-going activities.

The Practical Examination will be held at centres to be determined by the Board.

Special Paper

1. Four-part harmonic writing based on the syllabus for Advanced Paper I, but the questions will be of a more searching character and such as will test the resourcefulness of candidates.

2. Contrapuntal writing based on the syllabus for Advanced Paper I, except that three-part instead of two-part string writing will be required and that candidates will, when appropriate, be given the opportunity of writing for wood-wind instruments.

3. Melodic writing based on the syllabus for Advanced Paper I.

4. An essay on a choice of subjects based on the syllabus for Advanced Paper II, *Musical History*, giving candidates scope to show their individual interests and critical powers.

(A 16) GREEK (A 17) LATIN (in each subject two papers each of three hours will be set at the Advanced level; two "Special" papers each of two hours will also be set in each subject)

I. (a) Prose composition.

(b) Prescribed books, prose.

II. (a) Unseen translation.

(b) Prescribed books, verse.

Candidates will be required to offer one prose and one verse prescribed book. The questions set will include passages for translation, questions on grammar and syntax arising from the books and questions on the subject matter. The latter will require a knowledge of the matter of the prescribed books themselves such as is necessary for an intelligent study of the text and, in the verse book, a knowledge of the chief poetical metres.

Prescribed for 1966

GREEK¹

1. Herodotus vi, cc. 31—131 **or** Demosthenes, *Philippics* ii and iii and *de Pace*
and
2. Homer, *Odyssey* xxi and xxii **or** Sophocles, *Oedipus Tyrannus*.

LATIN¹

1. Cicero, in *Verrem* v, cc. 1—53 (§§1—140, *manus ipsa lictoris*) **or** Livy xxx
and
2. Virgil, *Georgics* iv **and** *Eclogues* vi and ix **or** Horace, *Odes* iii.

Special Papers (in each subject two papers each of two hours)

I. Prose composition.

II. Unseen translation.

OPTIONAL PAPERS

Candidates offering Greek may offer Greek Verse Composition (one paper of three hours: *Iambics*). Candidates offering Latin may offer Latin Verse Composition (one paper of three hours: **either** *Hexameters or Elegiacs*). There is no additional fee for these papers.

(A 18) FRENCH (A 19) GERMAN (A 20) SPANISH² (A 21) ITALIAN (A 22) RUSSIAN (A 23) WELSH³ OR (A 24) OTHER APPROVED MODERN LANGUAGES⁴

(In each subject there will be three papers and an oral examination at the Advanced level. In languages other than German, Advanced papers as follows will be set: I, three hours;

¹ Unless some other edition is prescribed, the text used by the examiners in selecting extracts for papers on prescribed books will be that of the Oxford Classical Texts, with such modifications of spelling as may seem to them desirable.

² Candidates offering Spanish will be expected to conform to the system of accentuation set by the Spanish Academy in *Nuevas normas de prosodia y ortografía* (1952, amended in 1959).

³ Two years' notice must be given if Welsh is to be offered at the Advanced level.

⁴ Application for other languages to be approved at the Advanced level must be made at least two years before the examination. A fee of £8 is also payable in addition to the normal examination fee; this fee must be paid by 1 January preceding the examination.

II, one and a half hours; III, three hours. In German Advanced papers will be as follows: I, three hours; II two hours; III, three hours. A "Special" paper of three hours will also be set in each subject.)

In German, Italian and Russian a candidate will be required to reach a satisfactory standard in Advanced Paper I before being awarded a pass in the subject; in Spanish a candidate will be required to reach a satisfactory standard in each of the three Advanced papers and also in the oral examination.

Advanced Paper I.

- (a) Translation into the language.
- (b) Free composition in the language on general subjects.

Advanced Paper II.

Translation from the language.

Advanced Paper III.

Prescribed books studied in themselves and in relation to literary history. Books will be prescribed each year (a) for detailed literary study, (b) for less detailed study.

Questions on books for detailed literary study will not necessarily include passages for translation, but candidates may be required to explain and refer to their context passages typical of the particular book or characteristic of the author or possessing features of historical interest; they will also be expected to show such knowledge of social and literary history as may be necessary for the appreciation of the books.

Questions will be set on a passage selected from each book prescribed for less detailed study; candidates may also be required to translate all or part of the passage and to answer questions relating to the book as a whole.

Oral Examination

- (a) *Dictation.* The passage will consist of about 150 words. Each section will be dictated twice, and the whole passage read again, time being allowed for corrections.
- (b) *Reading.* Candidates will be required to read aloud a passage or parts of a passage which they have had time to read through. Particular importance will be attached to accuracy in the production of vowels and consonants.
- (c) *Conversation.* Questions may be asked on the passage read aloud, on simple everyday topics and on the books prescribed for study.

Prescribed for 1966

FRENCH

III. All candidates will be required to answer three questions in Section (1), that is one on each of three books for detailed literary study, **and in addition**

either one question on a fourth book in Section (1)

or two questions in Section (2), that is one on each of two books for less detailed study.

Section (1)

For detailed literary study

1. Corneille, *Le Cid*.
- 2.*Molière, *Les Femmes savantes*.
3. *Mme de Sévigné, Choix de Lettres*, Wilson, Harrap.
4. Prévost, *Manon Lescaut*, King, Harrap.
5. Hugo, *Hernani*.
- 6.*The poems of Lamartine (omitting *L'Immortalité* and *La Vigne et la Maison*), Vigny (omitting *La Maison du Berger*), Hugo, Gautier and Baudelaire, as in *Nine French Poets*, Berthon, Macmillan.
7. Anatole France, *Le Crime de Sylvestre Bonnard* (full text).
8. Alain-Fournier, *Le grand Meaulnes* (Parts I and II).

* Provided that there is no alteration to the syllabus for the subject, these books will also be prescribed for 1967.

Section (2)

For less detailed study

9. Daudet, *Tartarin de Tarascon*.
10. Becque, *Les Corbeaux*, Lockerbie, Harrap.
11. Hémon, *Maria Chapdelaine*.
12. Chamson, *Les Hommes de la route*.
13. Troyat, *La Tête sur les Épaules*.

GERMAN

III. All candidates will be required to answer three questions in Section (1), that is one on each of three books for detailed literary study, **and in addition**

either one question on a fourth book in Section (1)

or two questions in Section (2), that is one on each of two books for less detailed study

or two questions in Section (3).

Section (1)

For detailed literary study

1. Goethe, *Götz von Berlichingen*.
2. Schiller, *Die Jungfrau von Orleans*.
3. Kleist, *Michael Kohlhaas*, Wilson, Macmillan.
4. Chamisso, *Peter Schlemihl*.
5. Grillparzer, *Sappho*.
- 6.*Hebbel, *Herodes und Mariamne*, Purdie, Blackwell.
- 7.*Carossa, *Eine Kindheit*, Bithell, Blackwell.

Section (2)

For less detailed study

8. Eichendorff, *Aus dem Leben eines Taugenichts*.
9. Löns, *Naturskizzen und Erzählungen*, Radcliffe, Nelson.
10. Kafka, *Die Verwandlung*, Hoover, Methuen.
11. Zweig, *Schachnovelle*, Zohn, Methuen.
12. Hochwälder, *Das heilige Experiment*, Foster, Harrap.

Section (3)

For background study

Five questions on German life and history, of which a candidate will be required to answer two, will be set within the scope of the texts listed below. Relevant information derived from sources other than these texts may be included in the answer to any question.

13. Baier, *Deutschland und die Deutschen* (second or later edition), Methuen.
14. Natan, *Neues Deutschland*, Blackwell.
15. Passant, *A Short History of Germany, 1815—1945*, Cambridge.
16. Sinnhuber, *Germany, its Geography and Growth*, Murray.

SPANISH

III. All candidates will be required to answer three questions in Section (1), that is one on each of three books for detailed literary study, **and in addition**

either one question on a fourth book in Section (1)

or two questions in Section (2), that is one on each of two books for less detailed study

or two questions on **one** of the periods of history prescribed under Section (3).

Section (1)

For detailed literary study

- 1.*Cervantes, *Rinconete y Cortadillo*.
2. Lope de Vega, *Fuenteovejuna*, Mitchell, Bell.
3. *Spanish Lyrics of the Golden Age*, pages 51—112, Tettenborn, Bell.
4. Larra, *Artículos escogidos*, Marín Molina, Bell.
5. Duque de Rivas, *Don Álvaro*.
6. Palacio Valdés, *La Hermana San Sulpicio*.
- 7.*Delibes, *El camino*, Polack, Harrap.

* Provided that there is no alteration to the syllabus for the subject, these books will also be prescribed for 1967.

Section (2)

For less detailed study

8. Alarcón, *El sombrero de tres picos*, Colección Austral.
9. Blasco Ibáñez, *La barraca*.
10. Camba, *Mis páginas mejores*.
11. Lorca, *La zapatera prodigiosa*, Street, Harrap.
12. Goytortúa, *Pensativa*, Walsh, Harrap.

Section (3)

A period of Spanish history

Either 1479—1556 **or** 1939 to the present day.

ITALIAN, RUSSIAN

Details may be obtained on application to the Secretary.

Special Paper (in each subject one paper of three hours)

1. Translation into the language.
2. Unseen for part translation and comment and alternatively questions set to test appreciation of an unseen passage or passages.
3. Questions of the essay type on the wider interests arising from the study of the works prescribed for Advanced Paper III. The questions will be answered adequately only by candidates whose reading has not been restricted to the set books.

USE OF STENCILS, MATHEMATICAL TABLES AND SLIDE RULES IN MATHEMATICS AND SCIENCE SUBJECTS

Candidates are permitted to use stencils and mathematical tables in papers in Advanced subjects 26 to 37. Mathematical tables will be supplied by the Board.

Slide rules may also be used in these papers but candidates should be sure that the slide rules used are capable of achieving the accuracy required. Indication must be given at each point where a slide rule has been used. If the slide rules carry formulae or data of any description, this matter must all be efficiently obscured so that no reference may be made to it in the examination room.

ADVANCED MATHEMATICAL SYLLABUSES

Two papers will be set in each of the four following subjects, each of the four subjects counting as one single Advanced subject: (A 26) *Mathematics (Pure Mathematics and Theoretical Mechanics)*; (A 27) *Further Mathematics (Pure Mathematics and Theoretical Mechanics)*; (A 28) *Pure Mathematics with Statistics*; (A 29) *Pure Mathematics*.

Any one of the four subjects may be offered by itself; at one sitting the following combinations **only** will be permitted:

- (i) (A 26) together with (A 27),
- (ii) (A 27) together with (A 28).

In all subjects the question papers will be so framed as to have regard to what can be expected of candidates who have spent two years in a sixth form. Questions and parts of questions will test understanding of general principles explicitly and not only implicitly.

(A 26) MATHEMATICS (Pure Mathematics and Theoretical Mechanics) (two papers each of three hours Paper I [Pure Mathematics, Paper II mainly Theoretical Mechanics] will be set at the Advanced level; a "Special" paper of three hours will also be set)

Mathematics (A 26) may be offered at the same sitting of the examination as Further Mathematics (A 27); it may not be offered at the same sitting as any of the following: Mathematics (O 25), Pure Mathematics with Mechanics (O 26), Pure Mathematics with Statistics (O 28 and A 28), Pure Mathematics (O 29 and A 29), Commercial Mathematics (O 30).

1. Elimination. The solution of simultaneous equations. Simple partial fractions. Arithmetic series, finite and infinite geometric series.

The binomial theorem for positive integral index (questions will not be set on greatest terms and sums of coefficients). The use of the binomial expansion for other indices.

Logarithms to any base. Use of the expansions of e^x , $\log_e(1+x)$.

Complex numbers. Sum, product and quotient of complex numbers in algebraic form. Equating real and imaginary parts. The cube roots of unity. Graphical representation of complex numbers by points.

Theory of the quadratic function and of the quadratic equation.

Graphs of ax^n , $a(x-h)^n$, simple polynomials, $(ax+b)/(cx+d)$.

(Familiarity with the inequality and modulus signs will be expected.)

2. Trigonometric ratios of angles of any magnitude. Circular measure. The addition theorems (proofs will not be required). The function $a \cos \theta + b \sin \theta$ and its transformation to the forms $R \cos(\theta + \alpha)$ or $R \sin(\theta + \alpha)$. Easy trigonometric equations (excluding general solutions).

Solution of triangles (proofs of formulae other than the sine and cosine rules will not be required). Area of a triangle: $S = \frac{1}{2}ab \sin C$, $S = \sqrt{s(s-a)(s-b)(s-c)}$. Area of a sector of a circle.

The approximations $\sin \theta \approx \theta \approx \tan \theta$, $\cos \theta \approx 1 - \frac{1}{2}\theta^2$.

Easy problems in two or three dimensions.

Graphs of the trigonometric ratios for all values of the angle, and of $a \cos \theta + b \sin \theta$.

3. Differentiation of algebraic, trigonometric and inverse trigonometric functions, e^x , $\log_e x$, and simple implicit functions.

Differentiation from parametric equations.

Tangents and normals. Maxima and minima, points of inflexion. Sketch graphs.

Rates of change e.g. gradients, velocity, acceleration, angular velocity. Small increments (one independent variable).

4. The definite integral as the limit of a sum, and its representation as an area; simple physical illustrations.

Integration as the inverse of differentiation. Integration by partial fractions, by substitution and by parts.

Application of integration to plane areas, volumes, mean values, centroids.

5. Elementary plane coordinate geometry: distances, angles, areas; the straight line; the circle.

Elementary treatment of curves represented by simple cartesian or parametric equations, e.g. the parabola ($y^2 = 4ax$; $x = at^2$, $y = 2at$), the ellipse ($x^2/a^2 + y^2/b^2 = 1$; $x = a \cos t$, $y = b \sin t$), the rectangular hyperbola ($xy = c^2$; $x = ct$, $y = c/t$), the curve $x^3 = y^2$; $x = t^2$, $y = t^3$.

Change of origin, without rotation of axes.

[Reference may be made in questions to "focus", "directrix" and "eccentricity" of the parabola or ellipse, but detailed knowledge of their interrelationship will not be required.]

6. The first order differential equation with variables separable. Applications to rectilinear motion, the exponential law of growth or decay and the rate of chemical reactions. (Knowledge of chemical and physical laws will not be assumed, but the ability to express stated laws mathematically may be tested.)

The differential equation $d^2y/dt^2 \pm n^2y = 0$. (Questions may be set involving (i) the setting up of the equation for a particular problem, (ii) a knowledge of the complete integral, (iii) the use of the complete integral to adjust the solution to initial conditions. Whenever it is regarded as permissible for the candidate to quote the complete solution, this will be indicated.)

7. Rectilinear motion: displacement, velocity, acceleration.

Examples of non-uniform acceleration involving simple cases of the differential equation $dv/dt = v dv/dx = f(t)$, $f(v)$ or $f(x)$. Simple harmonic motion. Simple pendulum.

Newton's laws of motion. Mass, momentum, force, work. Principles of the conservation of linear momentum and of energy. Power. Impulse.

Vectors: addition, subtraction, composition and resolution. Relative motion. Motion of a particle in a plane: free motion under gravity, uniform circular motion, conical pendulum; motion in a vertical circle.

Direct impact. Oblique impact between a particle and a fixed plane. Hooke's law applied to elastic strings and springs.

8. Forces as vectors. Forces acting at a point. The laws of friction.

Forces in a plane: moment of a force about a point, parallel forces, couples, reduction of a set of forces to a single force or to a couple. Centre of gravity.

Equilibrium of particles and rigid bodies under the action of coplanar forces. Reactions at joints. (Excluding graphical statics requiring drawings to scale.)

Special Paper

The paper will be set on the syllabus for Mathematics at the Advanced level.

(A 27) FURTHER MATHEMATICS (Pure Mathematics and Theoretical Mechanics)
(two papers each of three hours will be set at the Advanced level; a "Special" paper of three hours will also be set)

Further Mathematics (A 27) may be offered at the same sitting of the examination as either Mathematics (A 26) or Pure Mathematics with Statistics (A 28); it may not be offered at the same sitting as any of the following: Mathematics (O 25), Pure Mathematics with Mechanics (O 26), Pure Mathematics with Statistics (O 28), Pure Mathematics (O 29 and A 29), Commercial Mathematics (O 30).

(The following syllabus for Further Mathematics assumes that candidates attempting the subject will have a knowledge of the topics included in the syllabus for Mathematics (A 26) and should be read in conjunction with that syllabus.)

Both papers will consist of questions in Pure Mathematics and Theoretical Mechanics in approximately equal numbers.

1. The sum of the squares and cubes of the natural numbers, and other simple finite series.

Permutations and combinations.

The remainder theorem. Factorisation of polynomials. Relations between the roots and the coefficients of a polynomial equation; occurrence of non-real roots in conjugate pairs when the coefficients of the polynomial are real. Location of zeros of functions by consideration of changes of sign.

Graphs of polynomials and of quotients of quadratic functions.

General solutions of trigonometric equations.

Manipulation and use of determinants of the second and third order, excluding multiplication.

Hyperbolic functions and their inverses.

Expansions of $\sin x$, $\cos x$, $\sinh x$, $\cosh x$.

Complex numbers: trigonometric form; representation by a vector; modulus and argument. Product and quotient from the trigonometric form. De Moivre's theorem. Exponential form of a complex number.

2. Derivatives of the hyperbolic functions and their inverses.

Curvature of a curve given by $y=f(x)$ or by $x=f(t)$, $y=g(t)$.

Easy examples of the use of polar coordinates for defining and sketching curves and for finding areas; the formula $\tan \phi = r d\theta/dr$.

3. Length of a curve and area of a surface of revolution (excluding the use of polar coordinates).

Reduction formulae (as an application of integration by parts).

Simple infinite integrals, e.g.

$$\int_0^a dx/\sqrt{(a^2-x^2)}, \int_0^\infty dx/(1+x^2).$$

Simple properties of the definite integral (excluding differentiation with respect to limits or with respect to parameters in the integrand).

4. Elementary ideas in solid geometry with application to lines, planes and spheres. Cartesian coordinates in three dimensions. Direction cosines. The equations of a plane and a straight line.

5. The general solution of the equation $ad^2y/dt^2 + bdy/dt + cy = 0$, where a, b, c , are constants, with applications.

6. Motion of a particle on a smooth curve; tangential and normal components of acceleration. Simple cases of motion of a particle in two dimensions, using cartesian coordinates.

Oblique impact of elastic spheres.

7. Moments of inertia. Motion of a rigid body about a fixed axis. Principle of the conservation of angular momentum.

8. Analytic reduction of a set of coplanar forces by referring them to coordinate axes.

Special Paper

The paper will be set on the syllabus for Further Mathematics at the Advanced level.

(A 28) PURE MATHEMATICS WITH STATISTICS (two papers each of three hours will be set at the Advanced level; a "Special" paper of three hours will also be set)

Pure Mathematics with Statistics (A 28) may be offered at the same sitting of the examination as Further Mathematics (A 27); it may not be offered at the same sitting as any of the following: Mathematics (O 25), Pure Mathematics with Mechanics (O 26), Mathematics (A 26), Pure Mathematics (O 29 and A 29), Commercial Mathematics (O 30).

Questions may be set on any part of the syllabus in either Advanced Paper I or Advanced Paper II.

1. Functions of the general form cx^p , where p is a positive or negative integer, and their graphs. Arithmetic series; finite and infinite geometric series. The binomial theorem for a positive integral index. The use of the binomial expansion for other indices. Theory of the quadratic function and equation. Simple partial fractions. The solution of simultaneous equations. (Familiarity with the inequality and modulus signs will be expected.)

Questions will only be set on the following topics if they have a direct bearing on simple statistical problems: the sum of the first n natural numbers together with the sum of their squares and cubes; greatest terms and sums of the coefficients of the binomial expansion.

2. Trigonometric ratios of angles of any magnitude. Circular measure. The addition theorems (proofs will not be required). The function $a \cos \theta + b \sin \theta$ and its transformation to the forms $R \cos(\theta + \alpha)$ or $R \sin(\theta + \alpha)$. Easy trigonometric equations (excluding general solutions).

Solution of triangles (proofs of formulae other than the sine and cosine rules will not be required). Area of a triangle: $S = \frac{1}{2}ab \sin C$, $S = \sqrt{(s(s-a)(s-b)(s-c))}$. Area of a sector of a circle.

The approximations $\sin \theta \doteq \theta \doteq \tan \theta$, $\cos \theta \doteq 1 - \frac{1}{2}\theta^2$.

Easy problems in two or three dimensions.

Graphs of the trigonometric ratios for all values of the angle, and of $a \cos \theta + b \sin \theta$.

3. Elementary plane coordinate geometry: distances, angles, areas; the straight line; the circle.

Elementary treatment of curves represented by simple cartesian or parametric equations, e.g. the parabola ($y^2 = 4ax$; $x = at^2$, $y = 2at$), the ellipse ($x^2/a^2 + y^2/b^2 = 1$; $x = a \cos t$, $y = b \sin t$), the rectangular hyperbola ($xy = c^2$; $x = ct$, $y = c/t$), the curve $x^3 = y^2$; $x = t^2$, $y = t^3$.

Change of origin, without rotation of axes.

[Reference may be made in questions to "focus", "directrix" and "eccentricity" of the parabola or ellipse, but detailed knowledge of their interrelationship will not be required.]

4. Differentiation of algebraic, trigonometric and inverse trigonometric functions. Tangents and normals. Maxima and minima. Points of inflection. Sketch graphs. Rates of change e.g. gradients, velocity, acceleration, angular velocity. Knowledge and use of the exponential and logarithmic functions and their derivatives. Logarithms to any base. Differentiation of $e^x \log_e x$ and simple implicit functions. Use of the expansions of e^x , $\log_e(1+x)$.

5. The definite integral as the limit of a sum and its representation as an area; simple physical illustrations. Approximate numerical integration by means of the trapezoidal rule and Simpson's rule. Integration as the inverse of differentiation. Integration by partial fractions, by substitution and by parts. Applications of integration to plane areas, volumes and mean values.

6. The scope and limitations of Statistics. Frequency distributions, histograms, cumulative frequency graphs. Percentiles. Mean, variance and standard deviation by calculations from a set of observations.

7. Permutations and combinations. Probability. The addition and multiplication laws of probability. The binomial and Poisson distributions, their mean, variance and standard deviation. Mean, variance and standard deviation by integration over a mathematically specified continuous distribution. Their values for the normal and rectangular distributions.

8. Graphical and numerical treatment of the normal distribution with the use of tables. The normal distribution as an approximation to the binomial and to the Poisson distributions. Simple mathematical problems in which the distribution of one variable is deduced from the rectangular distribution of another variable functionally related to it.

9. Random sampling. Estimation of parameters of populations from statistics of samples. The use of the divisor $(n-1)$ for an estimated variance. Meaning of sampling distributions and standard errors of statistics with applications to large-sample tests of significance and confidence limits. Applications to problems e.g. involving differences between means of independent random samples.

10. Bivariate distributions and scatter diagrams. Computation of the equations of the two regression lines by the Principle of Least Squares. Interpretation of the two regression lines. The idea of correlation and limitations of its use. The product-moment coefficient of correlation and its significance. Spearman's coefficient of rank correlation.

11. Interpretation of a time series; seasonal variation, long term variation including the use of moving averages. Index numbers as weighted averages of percentage relatives, crude and standardized death rates.

Special Paper

The paper will be set on the syllabus for Pure Mathematics with Statistics at the Advanced level.

(A 29) PURE MATHEMATICS (two papers each of three hours will be set at the Advanced level; a "Special" paper of three hours will also be set)

Pure Mathematics (A 29) may not be offered at the same sitting of the examination as any of the following: Mathematics (O 25), Pure Mathematics with Mechanics (O 26), Mathematics (A 26), Further Mathematics (A 27), Pure Mathematics with Statistics (O 28 and A 28), Commercial Mathematics (O 30).

Candidates will not be expected to have covered the whole of the following syllabus; it will be sufficient to prepare only about three-quarters of the syllabus.

1. Elimination. The solution of simultaneous equations. Simple partial fractions. Arithmetic series, finite and infinite geometric series.

The sum of the squares and cubes of the natural numbers, and other simple finite series.

The binomial theorem for a positive integral index (questions will not be set on greatest terms and sums of coefficients). The use of the binomial expansion for other indices.

Logarithms to any base. The functions e^x and $\log_e x$; the hyperbolic functions and their inverses.

Expansions of e^x , $\log_e(1+x)$, $\sin x$, $\cos x$, $\sinh x$, $\cosh x$.

Complex numbers. Sum, product and quotient of complex numbers in algebraic form. Equating real and imaginary parts. The cube roots of unity. Graphical representation of complex numbers by points. Trigonometric form; representation by a vector; modulus and argument. Product and quotient from the trigonometric form. De Moivre's theorem. Exponential form of a complex number.

Theory of the quadratic function and of the quadratic equation. The remainder theorem. Factorisation of polynomials. Relations between the roots and the coefficients of a polynomial equation; occurrence of non-real roots in conjugate pairs when the coefficients of the polynomial are real. Location of zeros of functions by consideration of changes of sign.

Graphs of ax^n , $a(x-h)^n$, polynomials and quotients of quadratic functions.

Manipulation and use of determinants of the second and third order, excluding multiplication.

(Familiarity with the inequality and modulus signs will be expected.)

2. Trigonometric ratios of angles of any magnitude. Circular measure. The addition theorems (proofs will not be required). The function $a \cos \theta + b \sin \theta$ and its transformation to the forms $R \cos (\theta + \alpha)$ or $R \sin (\theta + \alpha)$. Easy trigonometric equations (excluding general solutions).

Solution of triangles (proofs of formulae other than the sine and cosine rules will not be required). Area of a triangle: $S = \frac{1}{2} ab \sin C$, $S = \sqrt{s(s-a)(s-b)(s-c)}$. Area of a sector of a circle.

The approximations $\sin \theta \doteq \theta \doteq \tan \theta$, $\cos \theta \doteq 1 - \frac{1}{2}\theta^2$.

Easy problems in two or three dimensions.

Graphs of the trigonometric ratios for all values of the angle, and of $a \cos \theta + b \sin \theta$.

3. Differentiation of algebraic, trigonometric and inverse trigonometric functions, $e^x \log_e x$, hyperbolic and inverse hyperbolic functions and simple implicit functions. Differentiation from parametric equations.

Tangents and normals. Maxima and minima, points of inflection. Sketch graphs.

Rates of change e.g. gradients, velocity, acceleration, angular velocity. Small increments (one independent variable).

4. The definite integral as the limit of a sum, and its representation as an area; simple physical illustrations.

Integration as the inverse of differentiation. Integration by partial fractions, by substitution and by parts. Reduction formulae.

Application of integration to plane areas, volumes, mean values, centroids, length of a curve, area of a surface of revolution.

5. Elementary plane coordinate geometry: distances, angles, areas; the straight line; the circle.

Elementary treatment of curves represented by simple cartesian or parametric equations, e.g. the parabola ($y^2 = 4ax$; $x = at^2$, $y = 2at$), the ellipse ($x^2/a^2 + y^2/b^2 = 1$; $x = a \cos t$, $y = b \sin t$), the rectangular hyperbola ($xy = c^2$; $x = ct$, $y = c/t$), the curve $x^3 = y^2$; $x = t^2$, $y = t^3$.

Change of origin, without rotation of axes.

[Reference may be made in questions to "focus", "directrix" and "eccentricity" of the parabola or ellipse, but detailed knowledge of their inter-relationship will not be required.]

6. Elementary ideas in solid geometry with applications to lines, planes and spheres. Cartesian coordinates in three dimensions. Direction cosines. The equations of a plane and a straight line.

7. Differential equations: first order equations, linear or with variables separable; applications. The differential equation $d^2y/dt^2 + n^2y = 0$.

8. Prime numbers. The theorem that the number of primes is infinite. H.C.F.; Euclidean algorithm. Uniqueness of factorisation (without proof); simple properties of divisors. Algebra of congruences. Fermat's theorem, $ap \equiv a \pmod{p}$, for prime p . Solution of $ax + b \equiv 0 \pmod{p}$ for prime p .

Rational and irrational numbers; recurring and non-recurring decimals.

Special Paper

The paper will be set on the syllabus for Pure Mathematics at the Advanced Level.

(A 31) PHYSICS (two papers (I and II) each of three hours and a practical examination consisting of one paper (III) of three hours will be set at the Advanced level; a "Special" paper of three hours will also be set. One syllabus only (as set out below) will be available.)

Physics may not be offered at the same sitting of the examination as either Physics-with-Chemistry or General Science I or II.

The examiners will assure that candidates possess a knowledge of the topics included in the Ordinary syllabus in Physics, and will be at liberty to set questions which involve such knowledge.

Questions will be such as to permit the use of either the centimetre-gram-second or the rationalized metre-kilogram-second system of units; as may be necessary, where electrical and magnetic units are involved, quantities will be specified in both systems.

Questions in which the main interest is in the mathematical processes involved will not be set.

The amplification of the syllabus indicates how certain items will be interpreted for examination purposes.

Each paper will consist of two sections. Section (1) will consist of eight questions requiring short answers. Section (2) will consist of six questions requiring longer answers. In both sections questions may be set on any part of the syllabus. Candidates will be required to answer six questions from Section (1) and three from Section (2).

1. *Mechanics*. Dimensions of physical quantities (excluding electrical units). Composition and resolution of coplanar vectors. Equilibrium of coplanar forces, moments, couples. Newton's laws of motion, unaccelerated absolute motion. Conservation of linear momentum. Work, power, kinetic and potential energy. Uniform motion in a circle. Laws of motion extended to rotation about a fixed axis; concept of moment of inertia. Newton's Law of Gravitation. Determination of G by Cavendish-Boys type of experiment; quantitative treatment of circular orbits. Simple harmonic motion; simple pendulum, oscillation of mass suspended by helical spring, torsional oscillation.

2. *Properties of materials*. Elasticity, stress and strain, limit of proportionality, elastic limit, yield point. Young's modulus and its determination, work done in stretching a wire. Surface tension: experimental illustrations, measurement by simple methods when angle of contact is zero, excess pressure inside a spherical bubble, rise in capillary tube.

3. *Heat*. Scales of temperature; liquid in glass, resistance, thermo-electric and gas thermometers. Calorimetric determinations by mixture, electrical heating, continuous flow. Postulates of simple kinetic theory. Derivation of expression for pressure of ideal gas ($p = \frac{1}{3} \rho c^2$), relation between temperature and molecular kinetic energy. Qualitative treatment of evaporation, diffusion, Brownian movement, surface tension. Saturated and unsaturated vapours. Simple treatment of the difference between ideal and real gases, descriptive account of van der Waals' equation. Thermal conductivity and its determination. First law of thermodynamics; relationship between mechanical and thermal units, and its determination. Adiabatic and isothermal changes. Specific heat of gases. Difference and ratio of principal specific heats, atomicity of gases. Qualitative treatment of second law of thermodynamics.

4. *Geometrical optics*. Reflection and refraction at plane surfaces. Total internal reflection and associated phenomena. Determination of refractive index of solids and liquids. Spherical mirrors. Refraction through a prism. Spectrometer. Deviation by small angle prisms. Thin lens (full formula). Thin lenses in contact. Simple treatment of telescope and microscope.

5. *Vibrations and waves*.

General characteristics. Amplitude, frequency, phase, wavelength, velocity. Progressive waves; longitudinal and transverse waves. Polarization of transverse waves. Doppler effect. Forced vibration and resonance.

Superposition of waves. Principle of interference. Stationary waves. Beats. Nature of diffraction.

Production, propagation and characteristics of sound. Determination of velocity of sound in free air and by resonance tube. Factors influencing the velocity of sound in gases. Loudness, pitch, quality. Vibrations of strings and air columns. Determination of frequency by sonometer.

Propagation and wave characteristics of light. Velocity of light; determination by rotating mirror methods, treated simply. Attempts to detect the effect of motion of the earth. Wave and corpuscular theories of light. Reflection, refraction and dispersion at plane surfaces by Huygens' secondary wavelets. Simple treatment of spectroscopy; emission and absorption spectra, solar spectrum. Electromagnetic spectrum; characteristics outside the visible range. Heat exchange by radiation; black body radiation, Stefan's law. Wien's displacement law. Quantum aspect of radiation; Planck's constant, photoelectric effect. Double slit type of interference experiment. Thin film interference effects. Simple treatment of diffraction pattern produced by a single slit. Measurement of wavelength using a plane transmission diffraction grating.

6. *Magnetism*. Magnetic field, magnetic moment, magnetic flux. Magnetic properties of iron and steel.

7. *Current electricity*. Magnetic effects of electric current; field at centre of circular coil, force on current-carrying conductor in a magnetic field, moving coil galvanometers, ammeters and voltmeters. Conductance and resistance. Electromagnetic and M.K.S. (practical) units of current and potential difference. Theory and use of Wheatstone bridge and potentiometer. Use of standard cell and standard resistance.

8. *Electrostatics*. Faraday's induction experiments. Force between charges, unit charge. Electric field, lines of force, potential, capacitance. Effect of dielectric. Capacitance of sphere and parallel plates. Capacitors, in series and in parallel. Energy of charged capacitor. The van de Graaff generator.

9. *Electromagnetic induction and alternating current.* Simple experimental phenomena and laws. E.m.f. produced in a disc and in a coil rotating uniformly in a magnetic field. Simple treatment of self and mutual induction, the henry. Use of search coil and ballistic galvanometer. Simple treatment of alternating currents. Root mean square values. LCR (series and parallel) circuits. Use of cathode ray oscilloscope.

10. *Electron, atomic and nuclear physics.* Cathode rays; deflection of beam in electric and magnetic fields, existence of electron, determination of e and e/m . Production and properties of X-rays. The electron volt. Control of electron streams as in cathode ray tube, diode, triode. Diode as rectifier, triode as amplifier and oscillator. Ionization in gases, ionization current, excitation and ionization by collision. Positive rays: determination of E/M , isotopes. Alpha- beta- and gamma-radiation: experimental recognition, experimental law of decay. Evidence for existence of nucleus. Unstable nuclei. Mass and energy: energy conditions of stability. The neutron, composition of nuclei. The extra-nuclear atom: reasons for emission of line spectra, X-ray and optical spectra.

Practical Examination (three hours)

In the Practical Examination experiments will be set involving operations with which candidates may be expected to have become familiar through laboratory work in connection with the syllabus. Where more than this is involved fuller instructions will be given. *Detailed accounts* of the relevant theory will not be required; credit will be given for good presentation of the work carried out as well as for evidence of care and accuracy.

Special Paper

1. The paper will be designed to test the ability of candidates to reason and to apply their knowledge of fundamental principles.

2. The limitations imposed by the amplification will apply also to the Special paper.

Amplification indicating how certain items in the Advanced syllabus will be interpreted for examination purposes.

1. *Mechanics.* Problems in dimensional analysis and questions on relative velocities will not be set. Static problems will not demand a knowledge of frictional forces. Examples of simple harmonic motion other than those listed will not be required. The introduction of moment of inertia as a constant of proportionality in rotational mechanics is envisaged. Mathematical derivations of moments of inertia for particular objects are excluded and questions will not be set on methods of experimental determination.

2. *Properties of materials.* Bulk and rigidity moduli are excluded.

3. *Heat.* Latent heat determinations are included in calorimetry, and a knowledge of cooling corrections for practical application will be assumed. Proof of the equation $Pv\gamma = \text{constant}$ will not be required. Experimental determination of the principal specific heats of gases and of γ are excluded. Hygrometry is excluded. Candidates will be expected to have a knowledge of one method of measuring thermal conductivity for a good solid conductor and one method for a bad solid conductor in the form of a slab or disc. They will also be expected to know that, whereas all the work done on a system may become heat, only part of the heat energy in a heat engine can be converted into work.

4. *Geometrical optics.*

Determination of refractive index for solids and liquids. Only the following experimental methods need be known*: real and apparent depth using rectangular block, minimum deviation using spectrometer, air-cell, grazing incidence using a glass block or prism (for solids and liquids).

Thin lenses and mirrors. In addition to the methods required at the Ordinary level only the following experimental methods for constants of lenses and mirrors need be known*: radius of a convex mirror using an auxiliary convergent lens, focal length of a convergent lens by the two-position method (using the formula $\frac{d^2 - l^2}{4d}$) and by a magnification method, focal length of a divergent lens using an auxiliary convergent lens separated from the divergent lens, radius of a surface of a convergent lens by Boys' method.

Candidates should be able to use and understand the no-parallax method of locating images.

* The examiners may set practical questions on methods not specified, but full instructions as to procedure will be given if any such questions are set.

The subject of thin lenses includes simple calculations on the correction of long and short sight by means of spectacles.

Candidates may use any consistent sign convention. Questions will not be asked on refraction at a single spherical surface.

The telescope and microscope. The emphasis is on the action of these instruments as illustrated by ray diagrams. Reflecting telescopes are included. Some understanding is expected of the meaning of resolving power and the factors which affect it, based on the form of the single slit diffraction pattern included elsewhere in the syllabus.

5. *Vibrations and waves.* Simple mathematical treatments of progressive and stationary waves are included. It will also be assumed that candidates can give a simple account of the effect of damping on resonance.

Nature of diffraction. Candidates will be expected to know that, while straight line propagation is the result of the superposition of the waves originating from all the sources in an unrestricted wave-front, diffraction results when the wave-front is restricted, becoming appreciable when apertures are not much larger than the wavelength.

No treatment of half-period zones is required.

Rotating mirror methods for the velocity of light. Both Foucault's method and Michelson's null method should be known, and it should be understood how the latter method is a development of the former and an improvement on it. The purpose and results of the Michelson-Morley experiments are required but not the experimental details.

Double-slit type of interference experiment. The experimental details of Young's experiment should be known together with either the Fresnel bi-prism or the Lloyd mirror experiment. The common bases of these experiments should be appreciated.

Thin film interference effects. Only the effects at normal incidence on non parallel-sided thin films are included. Newton's rings are included.

Single slit diffraction. Only the Fraunhofer pattern of a single slit aperture is included.

6. *Magnetism.* The couple acting on a magnetic dipole in a uniform field is included. For the properties of iron and steel it is assumed that the domain theory of magnetism will be introduced. Experimental determinations of magnetization curves are excluded.

7. *Current electricity.* The definition of the ampere is required both in terms of the field due to a circular current and in terms of the force between currents. The magnetic effect of an electric current includes the field due to a long straight current and the field due to a long solenoid. The dependence of these fields on currents and dimensions should be known but proof of formulae will not be required. Resistance and conductance in solids, liquids and gases is required, with Ohm's law as a special case. Numerical questions on galvanometers will be confined to those with rectangular coils. The constructional difference between the damped and ballistic forms of galvanometer is required; the mathematical theory of the ballistic galvanometer is not required.

8. *Electrostatics.* Questions on the experimental details of the methods of verification of the law of inverse squares will not be set.

9. *Electromagnetic induction and alternating current.* A simple vector treatment of alternating currents is required.

Cathode ray tube. Use limited to delineation of harmonic curves, frequency determination, display of simple phenomena using linear and sinusoidal time bases.

10. *Determination of e .* Millikan's method is sufficient.

Determination of e/m . Although candidates may describe any modern experiment known to them, questions involving numerical calculations will be confined to methods in which the cathode ray tube is used.

Ionization current. Measured by the gold-leaf electroscope or its equivalent.

Ionization by collision. The Franck-Hertz experiments are excluded.

Determination of E/M . A descriptive account of J. J. Thomson's parabola method is required but apparatus of the Bainbridge or Dempster type should be known for purposes of comparison.

Detection of alpha- beta- and gamma-radiation. Candidates are expected to be familiar experimentally with the Geiger counter method of detection. They should also know of the cloud and bubble chambers and of the scintillation and emulsion methods.

(It is expected that the Geiger counter and ratemeter or scaler will be used for the study of absorption of alpha and beta rays and for verifying the inverse square law for gamma rays.)

Evidence of existence of nuclei. A general understanding of alpha particle scattering experiments and the meaning of the results is sufficient.

Energy conditions of stability. The interpretation of the inequality between the mass of the parent nucleus and the sum of the masses of the products of instability should be known.

The neutron, composition of nuclei. Questions will not be set on the experiments leading to the discovery of the neutron. The study of sub-atomic particles is confined to the electron (not the positron), proton, neutron and alpha particle.

The reasons for accepting the neutron-proton model in preference to an electron-proton model are not required. Candidates should appreciate that the existence of a neutron-proton nucleus, and the emission of electrons from it, required the introduction of new concepts into the scheme of physics.

Line spectra. Examples based on particular models of the extra-nuclear electron system will not be set.

(A 32) CHEMISTRY (two papers (I and II) each of three hours and a practical examination consisting of one paper (III) of three hours will be set at the Advanced level; a "Special" paper of three hours will also be set)

Chemistry may not be offered at the same sitting of the examination as either Physics-with-Chemistry or General Science I or II.

The examiners will assume that candidates possess a knowledge of the topics included in the Ordinary syllabus in Chemistry and also a knowledge of elementary Physics and will be at liberty to set questions which involve such knowledge. The standard of the papers will be such as a candidate might reasonably be expected to attain in two years after reaching the Ordinary level.

The principles and reactions involved in the syllabus for the practical examination may be tested in the written papers.

In all sections of the papers questions will be set which test the candidate's knowledge of general principles and the examiners will assume that candidates are familiar with test-tube reactions.

Each paper will consist of three sections. In Section (1) the questions will be mainly of a general and physico-chemical character; in Section (2) questions will be set on inorganic chemistry; in Section (3) questions will be set on organic chemistry.

Each section will contain five questions, two unstarred which will contain only "basic" material (i.e. excluding those "supplementary" topics which are shown in italics below), and three starred which may contain material from both the basic and the supplementary parts of the syllabus. Candidates will be required to answer two questions, including at least one starred question, from each section. It will be possible for a candidate to satisfy the examiners on "basic" material alone.

1. Atomic theory, including a simple introduction to atomic structure; atomic numbers; stable isotopes. The periodic classification of the elements treated from the point of view of atomic structure.

Nuclear reactions; unstable nuclei; radioactivity of light and heavy elements, all treated qualitatively. The history of the development of the present atomic theory; Dalton, Gay-Lussac, Avogadro, Cannizzaro.

2. The empirical laws of chemical combination. Chemical equivalents and atomic weights and their determination. The concept of valency.

The limitations of the law of constant composition: non-Daltonian (Berthollide) compounds.

3. The means by which separate atoms unite to form individual molecules or three-dimensional structures as represented by the extreme types of

(a) electron sharing, e.g. CCl_4 and diamond;

(b) the co-ordinate or dative bond;

(c) electron transfer, e.g. K^+Cl^- .

Intermediate types of bonding, e.g. in gaseous HCl ; the crystal structure of CsCl as compared with that of KCl .

4. A simple treatment of electrolytic dissociation. The complete dissociation of strong electrolytes: strong and weak acids and bases; Ostwald's dilution law; hydrogen ion concentration; pH; neutralization; choice of suitable indicators in acid and alkali titration. Salt hydrolysis treated qualitatively.

The approximate relative sizes of a few simple atoms and ions e.g. the radius of K^+ is about half, and the radius of Cl^- about double that of the neutral atoms. The effect of cationic size and valency on salt hydrolysis. Complex ions.

5. Metals in equilibrium with aqueous solutions of their ions; the Electrochemical Series treated qualitatively.

Electrode potentials as a quantitative expression of this series.

6. A simple treatment of oxidation-reduction processes in terms of electron-transfer and electron sharing.

The comparison between the Electrochemical Series and Redox potentials of other systems.

7. The movement of ions in solution in an electric field and their discharge at electrodes. Ionic conductance treated qualitatively only. Faraday's laws of electrolysis; explanations of the reactions occurring at the electrodes during the electrolysis of aqueous solutions.

Elementary quantitative treatment of specific and equivalent and molar conductances and their use for estimating degree of ionic dissociation.

8. Qualitative treatment of the kinetic theory of gases. Kinetic concepts of the evaporation of liquids and solids and of the melting of solids. The effects of temperature and pressure on a gas limited to the equation $pV=RT$. Thermal dissociation.

Deviations of the behaviour of a gas from the equation $pV=RT$ considered qualitatively. The role of attractive forces between neutral molecules (van der Waal) in the formation of liquids. Gaseous diffusion and Graham's law.

9. The determination of the molecular weight of a volatile liquid by the method of Victor Meyer.

Molecular weight determination by the methods of Dumas and Regnault. (The method of limiting density is not included.)

10. Physical equilibria in two-phase and one or two component systems involving solid-liquid and liquid-vapour equilibria, and the effects of temperature and pressure. (Numerical calculations will not be set.)

The distribution of an unassociated, associated or dissociated solute between two immiscible solvents, including simple numerical examples.

11. Chemical equilibria in two-phase systems involving: (a) solubility products treated as an equilibrium between a sparingly soluble solid and its dissolved ions; (b) the dissociation of calcium carbonate and the action of steam on iron.

The vapour pressure of water over salt hydrates in equilibrium at a constant temperature (the phase-rule treatment is excluded). Arithmetical problems may be set on solubility products.

12. Properties of solutions which are related to concentration; vapour pressure, freezing point, boiling point, osmotic pressure. The concepts of volume concentration and molar-fraction. The determination of freezing point depression, boiling point elevation, vapour pressure lowering as methods of molecular weight determination in dilute solutions of simple non-volatile non-electrolyte solutes.

(Practical details will be required only for freezing point depression and boiling point elevation.)

The treatment should include molecular weight determination by these means of electrolytes and of associated and non-associated non-electrolytes. The colloidal state. Differences between colloidal dispersions and true solutions. Simple methods of preparing colloidal suspensions such as those of starch, gelatine, arsenious sulphide, ferric hydroxide.

13. Elementary thermochemistry: heats of reaction, formation and neutralization. Hess' Law of Constant Heat Summation. Heat changes associated with the process of solution are included. (Questions will not be set upon the experimental methods and, in view of varying practice, data given in questions will specify whether heat transferred is to be regarded as heat given out by the reaction or heat taken in.)

14. The law of mass action. Reaction velocity; the effects on the velocity of reaction of temperature and of concentration of reactants: simple qualitative kinetic interpretation of these effects. Catalysis.

15. Reversible reactions. Chemical equilibria and the effects of changes in temperature and pressure on the equilibrium position of a reversible reaction. (Qualitative treatment only.)

Simple quantitative examples of equilibria in homogeneous systems.

16. The chemistry of the elements, named below, based on the extended Periodic Table, copies of which will be provided for examination use.

The inert gases: isolation and structure.

Hydrogen.

Sodium: the properties of the metal; the chemistry of its oxides, hydroxide, chloride, hypochlorite, chlorate, carbonate, bicarbonate, sulphates, thiosulphate, sulphites, nitrate, nitrite.

Sodium hydride, cyanide, amide. The comparison of sodium with other alkaline metals.

Magnesium and calcium: the properties of the metals; the chemistry of their oxides, hydroxides, chlorides, carbonates, bicarbonates, sulphates; magnesium nitride.

Calcium hydride, calcium cyanamide; a comparison of the chemistry of magnesium with that of zinc and that of the alkaline earth metals.

Aluminium: the properties of the metal; the chemistry of its oxide, hydroxide, chloride, sulphate; alums.

Carbon: its allotropic modifications; the chemistry of carbon monoxide, carbon dioxide, carbonic acid and its salts.

A comparison of the chemistry of carbon with that of silicon and lead; carbon disulphide, carbon tetrachloride.

Silica, silicic acid, simple silicates.

Nitrogen: ammonia and ammonium salts; nitrous oxide, nitric oxide; nitrogen dioxide, dinitrogen tetroxide; nitrous and nitric acids and their salts.

Tin: its allotropic modifications; the chemistry of its oxides, sulphides, chlorides.

A comparison of the chemistry of nitrogen with that of phosphorus and arsenic.

Phosphorus: its allotropic modifications; the chemistry of its trihydride, oxides, chlorides; orthophosphoric acid and its salts.

Metaphosphoric acid, pyrophosphoric acid, and their salts.

Oxygen: water, hydrogen peroxide, ozone; classification and general properties of oxides. Sulphur: its allotropic modifications; the chemistry of hydrogen sulphide and metal sulphides, sulphur dioxide, sulphur trioxide, sulphuric acid, sulphurous acid and their common salts.

Sulphamic acid.

Chlorine, bromine, iodine: the chemistry of the elements and of their compounds with hydrogen, including the salts of the hydracids.

The preparation of fluorine and the comparison of its chemistry with that of the other halogens.

Iron and copper considered as typical transition elements; the chemistry of their oxides, chlorides, sulphates.

17. General methods available for the production of the metals (i.e. chemical reactions and essential conditions) as exemplified by the following: sodium, magnesium, zinc, aluminium, iron, lead.

The production of steel from cast iron.

18. The chemistry (i.e. chemical reactions and essential conditions, but excluding details of any industrial plant) involved in the large-scale production of the following: hydrogen, producer gas, water gas, ammonia, hydrochloric acid, sulphuric acid, nitric acid, sodium hydroxide, sodium hydrogen carbonate, phosphorus, chlorine, bromine, iodine.

19. A knowledge of the reactions of the cations and anions as involved in quantitative and qualitative analysis and as specified in the syllabus for the practical examination.

20. *A simple consideration of the three-dimensional structure of crystalline solids in terms of molecular crystals (e.g. sulphur, naphthalene), macromolecular crystals (e.g. ice, diamond), ionic crystals (e.g. sodium chloride, magnesium oxide).*

21. Classical structure theory in organic chemistry. Principles underlying the determination of empirical, molecular and structural formulae. Homologous series. Structural isomerism.

Simple stereochemistry of carbon; optical isomerism (lactic acid) and geometric isomerism (maleic and fumaric acids).

22. The detection of the elements nitrogen, sulphur, chlorine, bromine and iodine in organic compounds.

23. The processes of ether extraction, crystallisation, drying and distillation (including a simple qualitative treatment of steam distillation) as used in the purification of organic compounds. The determination of melting point and boiling point as tests of purity.

24. General methods of preparation and characteristic properties of simple paraffin hydrocarbons. Saturated compounds and substitution.

25. Organic chemistry as the chemistry of characteristic groups. The methods of introduction into a compound, the detection, the characteristic reactions and the variations of chemical behaviour of the following groups as shown by a study of the classes of compounds mentioned.

—OH (monohydric alcohols, phenol, acids).

Halogen (alkyl, aryl and acyl halides).

=C=O (aldehydes and ketones).

—COOH (monocarboxylic acids; esters).

—NH₂, =NH, ≡N (primary, secondary and tertiary amines; quaternary ammonium compounds; amides).

—CN (nitriles).

=C=C=, —C≡C— (olefines, acetylene).

The behaviour of characteristic groups in bifunctional compounds, illustrated by a simple consideration of vinyl compounds, hydroxy-acids, dicarboxylic acids and amino acids.

26. The properties of benzene and a very elementary consideration of its structure. Substitution reactions of the nucleus (halogenation, nitration, sulphonation) and the properties and transformations of the products. The chemical behaviour of the groups listed in §25 when in the nucleus or the side chain of aromatic compounds. (Di-substituted compounds and directive effects are not included.)

The formation and reactions of simple diazonium compounds.

27. A knowledge of the essential experimental details of the laboratory preparation and purification of the following organic compounds will be required: ethyl bromide, ethyl benzoate, nitrobenzene, *m*-dinitrobenzene, aniline, acetanilide.

Benzoyl chloride and benzamide; the Hofmann degradation of acetamide; glycine; benzene azo-β-naphthol; acetaldehyde (in aqueous solution).

28. *Elementary indication of the nature of the following biologically important materials: carbohydrates, fats, polypeptides, proteins, urea.*

29. *The simple structure of linear polymers; illustrated by polythene, polyvinyl compounds, nylon, terylene. (The mechanism of polymerisation is excluded.)*

30. *Fermentation processes, petroleum, coal tar and acetylene as large-scale sources of organic compounds.*

Practical Examination (three hours)

Books and laboratory notebooks may be used during the Practical Examination. In all problems set in the Practical Examination sufficient working details will be given. If any problems are set which are not clearly within the limits defined by the practical syllabus, sufficient information will be given in the question paper to bring the problems within these limits.

1. Candidates will be required to be familiar with the use of the balance and to be able to prepare solutions of known concentration from materials provided. No restriction is placed on the type of balance used, whether the older free-swinging type with removable weights or the newer aperiodic types with built-in weights. The exercise set will always be such that, provided the weight of material measured out by the candidate is within ± 10 milligrammes of its true weight the answer to the exercise will not be displaced for this reason by an amount which would lead to loss of marks.

Gravimetric analysis, that is the weighing of precipitates, is excluded from the practical syllabus.

A knowledge of the following volumetric processes will be required: the estimation of (a) strong and weak acids and alkalis, (b) ferrous iron, oxalic acid and oxalates by potassium permanganate, (c) iodine by sodium thiosulphate, and hence those oxidising agents capable of liberating iodine from potassium iodide, (d) halides in neutral solution by silver nitrate.

The weighing test and volumetric exercise may be extended by requiring candidates either to perform simple stated tests on the materials provided or to identify these materials. In such an event there will be a corresponding reduction in the requirements of the qualitative exercise.

2. Qualitative analysis of simple salts or mixtures of salts containing in all not more than four radicals. The radicals included will be limited to the following: Na^+ , K^+ , Mg^{2+} , Ca^{2+} , Ba^{2+} , Cr^{3+} , Mn^{2+} , Fe^{2+} , Fe^{3+} , Co^{2+} , Ni^{2+} , Cu^{2+} , Ag^+ , Zn^{2+} , Cd^{2+} , Hg^{2+} , Hg_2^{2+} , Al^{3+} , Sn^{2+} , Sn^{4+} , Pb^{2+} , Sb^{3+} , Bi^{3+} , NH_4^+ , S^{2-} , Cl^- , Br^- , I^- , CO_3^{2-} , NO_3^- , PO_4^{3-} , SO_4^{2-} , SO_3^{2-} .

Where mixtures are set they will not contain more than one metal in any given group as classified in standard analytical tables. For this purpose lead is to be taken as occurring both in Group I (Hydrochloric acid precipitation) and in Group II (Hydrogen sulphide precipitation). So called "phosphate separations" will not be required.

"Special" Paper

The paper will be set on the Advanced syllabus. An ample choice of questions will be provided.

(A 34) **BOTANY** (two papers (I and II) each of three hours and a practical examination consisting of one paper (III) of two and a half hours will be set at the Advanced level; a "Special" paper of three hours will also be set)

Botany may not be offered at the same sitting of the examination as either Biology or General Science I or II (Ordinary or Advanced).

The examiners will assume that candidates possess a knowledge of the botanical topics included in the Ordinary syllabus in Biology and will be at liberty to set questions which involve such knowledge.

Candidates will be expected to show sufficient acquaintance with the elementary chemical and physical principles underlying the plant physiology of the syllabus. They should also have performed simple physiological experiments within the scope of the syllabus.

The examination is intended to test observation in the field as well as practical work in the laboratory.

A candidate will be required to satisfy the examiners in the practical examination before being awarded a pass in the subject.

1. The morphology and anatomy of green herbaceous plants and woody perennials.
2. The elements of plant physiology including metabolism, growth and the response of plant organs to stimuli. The recognition and identification of the commoner substances found in plants.
3. Reproduction in flowering plants. Pollination mechanisms. Seed production. Processes of germination.
4. Modification of plant organs for storage; natural and artificial means of vegetative propagation.
5. Heterotrophic nutrition in higher and lower plants. The structure, modes of nutrition and life-cycles of selected fungi (*Mucor*, *Cystopus*, *Erysiphe*, a gill fungus) and bacteria with special reference to parasitism and saprophytism. The carbon and nitrogen cycles. Mycorrhiza.
6. The general characteristics of plant communities; the relation between plants and their environment illustrated by a detailed study of a well-defined habitat.
7. The formation and composition of soil; its relation to plant growth in nature and in agriculture. Principles of crop rotation. The distribution and biology of common weeds.
8. The general outline of the evolution of plants with special reference to the morphology and life-cycle of *Chlamydomonas*, *Spirogyra*, *Vaucheria*, *Fucus*, a moss, a fern and a conifer.
9. The principles of the classification of plants as illustrated by *Ranunculaceae*, *Rosaceae*, *Leguminosae*, *Labiatae*, *Compositae*, *Liliaceae*. Some typical examples of generic and specific differences should be studied.
10. Cell structure and division. Mitosis and meiosis. An elementary treatment of Mendelian inheritance (monohybrid and dihybrid crosses) and the bearing of Mendelian laws on the improvement of economic crop plants. The chromosome theory of heredity. An elementary knowledge of evolution including the contributions of Darwin in this field.

Practical Examination (two and a half hours)

The practical examination will be taken at centres to be determined by the Board. Candidates may be required to make and mount preparations for microscopical examination (familiarity with the use of aniline chloride (or aniline sulphate) will be assumed), to draw and describe the tissues of such preparations, to set up and perform simple experiments illustrating the elementary facts of growth and nutrition of green plants and to identify with the aid of a Flora¹ typical specimens of British flowering plants. They may also be required to describe and identify specimens.

Each candidate must bring to the examination a razor, a hand-lens, a sharp knife, a pair of mounted needles, drawing pencil, india-rubber and a copy of an approved Flora¹ for use as directed. A microscope, slides and cover-slips will be provided but candidates may bring their own microscopes if they wish. **Candidates will be expected to be familiar with the use of a microscope fitted with a condenser.**

Special Paper

The syllabus is the same as at the Advanced level but questions will be so framed as to permit candidates to give evidence of wider reading and wider experience in the laboratory and field.

(A 35) **ZOOLOGY** (two papers (I and II) each of three hours and a practical examination consisting of one paper (III) of two and a half hours will be set at the Advanced level; a "Special" paper of three hours will also be set)

Zoology may not be offered at the same sitting of the examination as either Biology or General Science I or II or Human Biology (Ordinary or Advanced).

Candidates should possess a knowledge of those portions of elementary Chemistry and Physics which are necessary to the proper understanding of the subject-matter of the syllabus.

Candidates will be expected, wherever possible, to show in their answers that they have done some practical work and made personal observations on the subjects they are discussing.

A candidate will be required to satisfy the examiners in the practical examination before being awarded a pass in the subject.

1. An elementary study of the structure and physiology of a mammal.

(a) Nutrition (diet, digestion). Teeth and jaws (dog, rat, sheep) in relation to types of food.

(b) Circulation and vascular system (blood and lymph).

(c) Respiration.

(d) Excretion.

(e) Reproduction.

(f) Control of the body by nervous and endocrine mechanisms, including an elementary knowledge of the principal sense organs. (Neither the histology of the endocrine glands nor the biochemistry of their secretions is required.)

(g) The skeleton of the rabbit (excluding the skull) and the skull of the dog. Muscle action. Joints.

The above should form an introduction to the study of the general metabolism and energy relationships of living organisms.

2. An elementary study of protoplasm. The structure of a cell. Cell division.

3. A study of mammalian tissues shown by epithelia, areolar connective tissue, blood, cartilage, bone, muscle, medullated nerve fibre and neuron. Aggregations of tissues into organs shown by a study of sections of skin, stomach, ileum, liver, kidney and spinal cord of a mammal. The skin and blood of a frog.

4. The structure, mode of life and life-history of the following animals to illustrate the general characteristics of animal organization. Wherever possible they should be studied alive as well as dead. The examples in italics are to be dissected: *Amoeba*, *Paramecium*, *Euglena*, *Monocystis*, *Hydra*, *earthworm*, *cockroach*, *Amphioxus*, *dogfish*, *frog*, *rat*. Elementary

¹ The following Floras are approved for the purposes of the Board's examinations: Flora of the British Isles, Clapham, Tutin and Warburg, Cambridge; Excursion Flora of the British Isles, Clapham, Tutin and Warburg, Cambridge.

comparative morphology of the dogfish, frog and mammal, with especial reference to their main environmental demands as exemplified by (a) breathing mechanisms and associated differences in the hearts and vascular systems, (b) locomotion, (c) jaw suspension and ear ossicles.

5. The principles of animal classification as exemplified by the systematic position and the evolutionary relationships of the animals specified in §§ 4 and 10 and their relation to the following groups. The characters of these groups as exemplified by the types named in brackets.

<i>Protozoa</i>	Sarcodina (Amoeba)		
	Ciliata (Paramecium)		
	Flagellata (Euglena)		
	Sporozoa (Monocystis and Plasmodium)		
<i>Metazoa</i>	Coelenterata (Hydra)		
	Platyhelminthes (tape-worm)		
	Nematoda (Ascaris)		
	Annelida (earthworm)		
	Arthropoda	Crustacea (crayfish*)	
		Arachnida (spider*)	
		Insecta (cockroach and insects named in § 10)	
	Mollusca (snail*)		
	Chordata	Acrania	Cephalochordata (Amphioxus)
		Craniata	Pisces (dogfish, etc.), Amphibia (frog) Reptilia (lizard*) Aves (bird*) Mammalia (rat)

6. Sexual and asexual reproduction. Gametogenesis and the chief types of ova. Microscopic structure of ovary and testis of a mammal.

7. An elementary study of embryology limited to the following:

- Fertilization and cleavage as exemplified by Amphioxus, frog and chick.
- The early development of Amphioxus, sufficient only to illustrate the process of gastrulation and the formation of the mesoderm and coelom.
- The development of the frog, only so far as to show how the main chordate features (mesoderm, nerve cord, notochord, gill clefts and tail) are gradually established.
- The development and functions of the amnion, chorion, allantois and yolk sac in the chick.
- The early development of the rabbit to explain the process of implantation and the structure and function of the placenta.

8. Organic evolution and the nature of the evidence supporting it.

9. Variation and heredity. The contributions of Lamarck and Darwin to the knowledge of methods of evolution. An elementary treatment of Mendelian inheritance. Monohybrid and dihybrid crosses. The chromosome theory of heredity. Sex chromosomes and sex-linkage.

10. A general and elementary treatment of the interactions between the animal world and man illustrated by the following. This study should be limited to external features, life-history, transmission, economic significance and control measures employed.

(a) Harmful organisms exemplified by a study of the mosquito and malarial parasite, a tape-worm, a plant eel-worm, lice, fleas, the house-fly, the clothes moth, and of insect pests of cultivated plants (aphids, cabbage white butterflies, chafer and click beetles, crane-flies).

(b) Beneficial organisms exemplified by honey bees, ichneumon flies, food fishes (herring, cod, salmon).

11. **Either** the natural history, studied personally, of *one* natural group of animals (e.g. Lepidoptera, birds) **or** the study "in the field" of the habits, life histories, food relations and adaptations to physical environment of the animals found in *one* well-defined habitat, e.g. ponds and streams, woodlands and hedges, the seashore, an urban garden.

Practical Examination (two and a half hours)

The practical examination will be taken at centres to be determined by the Board. Candidates may be required to make dissections or temporary preparations of or from the types indicated in § 4 of the syllabus. They may also be required to identify and describe preparations or specimens illustrating the subject-matter of the syllabus, except that only whole specimens of the animals marked with an asterisk in § 5 may be set in the practical examination.

Each candidate must bring to the examination a hand-lens, drawing pencil, india-rubber and suitable dissecting instruments. A microscope, slides and cover-slips will be provided but candidates may bring their own microscopes if they wish. **Candidates will be expected to be familiar with the use of a microscope fitted with a condenser.**

Special Paper

The syllabus is the same as at the Advanced level but questions will be so framed as to permit candidates to give evidence of wider reading and wider experience in the laboratory and field.

(A 36) BIOLOGY (two papers (I and II) each of three hours and a practical examination consisting of one paper (III) of three hours will be set at the Advanced level; a "Special" paper will also be set)

Biology may not be offered at the same sitting of the examination as either General Science I or II or Human Biology or Agricultural Science.

Candidates should possess a knowledge of those portions of Chemistry and Physics which are necessary to the proper understanding of the syllabus. The examiners will assume that candidates have a knowledge of the topics included in the Ordinary syllabus in Biology and will be at liberty to set questions which involve such knowledge.

Candidates will be expected to acquire a fundamental knowledge of mammals and flowering plants on the lines indicated in Sections (1) and (2) of the syllabus. Whilst the topics included in the remaining sections necessarily involve material which is relevant to Sections (1) and (2), it is nevertheless expected that candidates in the course of their studies will examine a wide range of living organisms. Wherever appropriate, topics should be related to man.

Papers I and II will each consist of two sections, A and B, each section containing six questions. Topics printed in italic type will be excluded from Section A. Questions in Section B will range over the whole syllabus. Candidates will be required to answer five questions, including at least two from each section.

SECTION (1). The general biology, anatomy and physiology of mammals, and especially of man. (The rat is to be dissected and preparations of the rabbit skeleton examined; apart from jaws and teeth, details of skull are not required.)

1. Skeleton; joints and muscles for support and movement; elementary physiology of muscular contraction.

2. Food; methods of feeding in relation to teeth and diet. Functions of alimentary canal including basic physiology of digestion, absorption, conversion, storage and transport of food (see also 1.8 and 4.4).

3. Blood, its functions and circulation, blood groups; heart, arteries, veins and capillaries; lymph.

4. Mechanism of breathing; movement of oxygen, carbon-dioxide and water vapour; gas exchange; loading and unloading of blood in lungs and tissues.

5. Production and excretion of nitrogenous waste; kidneys and skin in relation to thermo-regulation and water control.

6. Co-ordination by endocrine and nervous systems; reflex, voluntary and involuntary action (see also 4.5).

7. Structure and function of the reproductive system, including a simple outline of development to illustrate implantation, the function of the placenta and parturition.

8. The histology of the following: epithelia, muscle, cartilage, bone, blood and nervous tissue.

SECTION (2). The general biology, structure and physiology of flowering plants.

1. Anatomy and morphology, specifically related to function, of stem, leaf and root of herbaceous terrestrial flowering plants; modifications of these organs. Secondary thickening, cork-formation and leaf-fall in a deciduous woody dicotyledon. Growth forms to illustrate perennation, propagation and survival.

2. Basic physiology of photosynthesis, respiration and gas exchange in plants; food storage and translocation; detection of reserves.

3. Uptake of water; ionic dissociation; uptake of ions as an active process; inorganic requirements of plants; turgor and osmotic relations of cells and tissues; loss of water from plants.

4. Principles of flower and fruit structure; floral mechanisms, including insect and wind pollination; dispersal.

5. Outlines of sexual reproduction, including pollen-tube growth, fertilisation and *embryo-formation*; seed structure, dormancy and germination.

SECTION (3). The characteristics of living cells.

1. Introduction to the chemistry of cell constituents such as the following: carbohydrates, organic acids, fats, nitrogenous compounds (including amino-acids, proteins and nucleic acids). *Viruses*.

2. The components of the cell; the cell as a unit of living matter; differences between plant and animal cells.

3. Forms of energy and work; enzymes as catalysts in hydrolytic and oxidation-reduction reactions.

4. Photosynthesis as a unique process of energy gain; storage of energy in organic compounds; aerobic and anaerobic respiration in relation to energy yield; simple account of ATP currency.

5. Mitosis. Sexual reproduction. Alternation of syngamy and reduction, as illustrated by basic types of life-history. Meiosis, leading to recombination and reduction, contrasted with mitosis.

SECTION (4). Differentiation, integration and co-ordination within whole organisms

1. Unicells, colonies and multicellular organisms. Specialisation and division of labour within and between cells. Levels of organisation in living things.

2. Development and differentiation of the whole organism (see also 1.7 and 2.5). *Expression of gene action*. Metamorphosis. Main requirements for growth; its measurement.

3. Aqueous and gaseous diffusion and exchange (see also 1.4 and 2.2); *selective transfer of solutes between organism and environment*; osmo-regulation, excretion.

4. General principles of nutrition (see also 1.3, 2.3, 3.4 and 5.3); autotrophs and heterotrophs.

5. *Maintenance of stability and co-ordination of function in organisms* (see also 1.6).

6. Locomotion in animals and lower plants. Sense organs and reflexes, *instinctive behaviour, intelligent behaviour and learning*.

7. Restricted movements in plants due to growth and turgor; growth-regulating substances; effects of light and gravity.

8. Sexual differentiation in plants and animals. Adaptations in relation to outbreeding or inbreeding in plants and animals; methods of achieving fertilisation, *including mating behaviour in animals; protection, training and dispersal of offspring*. Non-sexual reproduction (see also 2.1).

SECTION (5). Ecology. (In this section the examiners will look for evidence of individual or group study of the fauna and flora of particular areas.)

1. Types of environment. Communities; *ecological niches and micro-climates*. Simple ecological methods for assessing the physical characteristics of the environment and the inter-relationships of the community in occupation.

2. Nature, origin and development of soils; factors affecting texture, nutrient status, water content and aeration of soils. Biotic component of soil. Nitrogen, carbon and mineral cycles.
3. The interdependence of organisms. Food chains, pyramid of numbers. Special methods of nutrition (see also 4.4) with examples of commensalism, symbiosis, parasitism and saprophytism.
4. *Dynamic nature of a community; basic ideas about succession, competition and fluctuation in population. Effects of season on plants and animals. Social organisation in animals. Factors influencing colonisation and seral change.*
5. *The use and construction of simple keys for the identification of common plants and animals.*

SECTION (6). Genetics and Evolution.

1. Principles of Mendelian inheritance, including mono- and di-hybrid crosses; linkage (see also 3.5). Variation through re assortment, recombination and mutation. *The effects of inbreeding and outbreeding systems on the frequency of homo- and hetero-zygosis. Natural selection operating through competition, population pressure and environmental change (see also 4.2).*
2. Chromosome theory of heredity (see also 3.5). *Simple account of idea of DNA as storing and conveying specific genetic information, mediated via RNA through enzyme systems, and controlling processes in the cell (see also 4.2).*
3. Concept of organic evolution. The nature of the evidence for evolution. Impact of modern views upon those of Darwin and his contemporaries. *Controlled selection in plant and animal breeding. Origin of species through mechanisms of selection and isolation. Problems of adaptation and survival and their solution (see also 4.4); increasing independence of the environment.*

Practical Examination (three hours)

(Attention is drawn to the modifications printed in bold type; these have been adopted since the revised syllabus was provisionally issued in July 1963 (RS/N66A).)

The practical examination will be taken at centres to be determined by the Board. Each candidate must bring to the examination a razor, dissection instruments, a hand-lens, drawing pencil and india-rubber. A microscope, slides and cover-slips will be provided. **Candidates will be expected to be familiar with the use of a microscope with a condenser.**

Candidates may be required to make and mount temporary preparations for microscopical examination, to draw and describe the tissues of such preparations and to perform simple experiments illustrating the elementary physiology of green plants. **The following stains will be provided by the Board for use in the practical examination: aniline chloride (or sulphate), iodine in potassium iodide solution, Sudan III solution. The use of other stains will not be permitted.** Candidates may also be required to describe and indicate the relationships of specimens, to identify and describe microscopic preparations of simple tissues, to show a practical knowledge of the subject-matter of the syllabus and elementary methods of manipulation, and to dissect a rat.

Special Paper

The syllabus is the same as at the Advanced level but questions will be so framed as to permit candidates to give evidence of wider reading and wider experience in the laboratory and the field.

(A 37) GEOLOGY (two papers (I and II) each of three hours and a practical examination consisting of one paper (III) of three hours will be set at the Advanced level; a "Special" paper of three hours will also be set)

1. The earth as a planet, its form, major surface features and magnetic field.
2. Land forms resulting from river, wind, glacial and marine denudation and deposition. Volcanic landforms.

3. Elements of the crystal structure of a mica, a pyroxene, an amphibole and orthoclase feldspar as examples of the relation between atomic structure and such features as crystal form and cleavage. Growth of crystals from gaseous, aqueous and magmatic solutions.

Identification of the following minerals by means (as may be appropriate) of their modes of occurrence, chemical composition, reaction with dilute hydrochloric acid, crystal form, cleavage, hardness, specific gravity, magnetism, colour, streak and lustre: quartz, potash feldspar, plagioclase feldspar, muscovite, biotite, hornblende, augite, olivine, chlorite, garnet, calcite, dolomite, chalcopyrite, galena, sphalerite (zinc blende), pyrite, hematite, magnetite, limonite, barytes, fluorite, gypsum, halite.

4. Weathering. Erosion. Transportation and deposition of sediment. Occurrence of subaqueous and subaerial deposits. Post-depositional changes. Bedding, current bedding, graded bedding and slumping. Coral reefs. The composition, origin and classification of the following sedimentary rocks: breccia, conglomerate, sandstone, greywacke, siltstone, mudstone, shale, limestones (including chalk and tufa), dolomite rock, gypsum, rock salt, flint (and chert), clay ironstone, peat, coal.

5. Magmatic rocks. Types of volcanic activity (Hawaiian, Strombolian, Vulcanian, Peléan, fissure eruptions). Volcanic products (subaerial and marine lavas, pumice, ash and tuff, agglomerates, gaseous products). Distribution of volcanoes over the earth's surface. Possible causes of vulcanicity. Ancient vulcanicity in the British Isles. Intrusions (dykes, ring dykes, sills, cone-sheets, stocks, batholiths). Textures, structures and mineral composition of the following common magmatic rocks: granite, microgranite, rhyolite, obsidian, syenite, trachyte, diorite, andesite, gabbro, dolerite, basalt. Sequence of crystallisation in common magmas and the elements of magmatic differentiation.

6. Thermal, cataclastic and regional metamorphism. Relict structures showing sedimentary or magmatic origin. The characters and mode of occurrence of hornfels (including spotted slate), marble, slate, phyllite, schist, gneiss, fault breccia, mylonite.

7. Earth movements. Earthquakes. The seismograph. Core, mantle, crust. Sial, sima. Isostasy. Continental drift. Dip and strike. Cleavage, joints. Geometry of outcrop of strata. Folds and faults. Structure of a fold mountain range. The major structural features of the British Isles.

8. Palaeontology. Fossilization. Use of fossils in correlation of strata; fossils as evidence for evolution. Evidence of structure of organisms to be obtained from hard parts; probable environments and geological time ranges of the following groups: corals, brachiopods, nautiloids, ammonoids, belemnoids, pelecypods (lamellibranchs), gastropods, crinoids, echinoids, trilobites, graptolites. Carboniferous plants. The general sequence of the main vertebrate groups. The geological history of the Equidae.

9. Principles of stratigraphy. Law of superposition. Unconformity. Facies, correlation and palaeogeography illustrated by examples drawn from the British stratigraphical column. Absolute and relative dating of rocks. Age of the earth.

10. Applied geology. Fossil fuels, iron-ores, bauxite, minerals in veins as exemplified by the North Pennine and Cornish ore-fields; building and road stones, slates, brick-clays, limestone, sand and gravel. **Evaporites.** Underground water and water supply.

11. Local geology. Knowledge of the geology of the school district or other district with special emphasis on the evidence of the candidate's field work and personal observation.

Practical Examination

1. The interpretation of simple geological maps and the drawing of geological cross-sections. Graphical determination of dip values, displacements on faults, etc., by construction of stratum contours.

2. The identification in hand specimens of all rock and mineral types named above.

3. Reference of the following fossils to their biological groups: the rugose corals, tabulate corals, scleractinian corals (hexacorals); inarticulate and articulate brachiopods (an orthid, a strophomenid, a productid, a rhynchonellid, a terebratulid and a spire-bearing brachiopod); nautiloids (*Nautilus* and an orthoconic nautiloid); ammonoids (goniatitic, ceratitic, ammonitic); *Belemnites*; pelecypods, i.e. lamellibranchs (an active and an attached form); gastropods; a crinoid; a regular and an irregular echinoid; trilobites; a dendroid, a pendant, a biserial and a uniserial graptolite. Carboniferous plants. Description of fossils by labelled diagrams.

4. The description of simple geological phenomena as seen on photographs.

5. Candidates must bring to the Practical Examination their original field note books (NOT fair copies) for inspection.

Special Paper

The syllabus is the same as at the Advanced level but questions will be so framed as to permit candidates to give evidence of wider reading and wider experience in the laboratory and field.

(A 42) WOODWORK (two papers each of three hours and a practical examination consisting of two parts each of three hours)

Woodwork may not be offered at the same sitting of the examination as Paper III in Art (Advanced).

I.

1. *Tools*

The evolution, construction, manipulation and general maintenance of hand wood-working tools. A working knowledge of the power-driven wood-turning lathe.

2. *Materials*

Common timber trees: their structure and growth, physical properties, maturity, felling, conversion into shipping and marketed forms, geographical distribution and main sources of supply. A detailed knowledge of seasoning and preservation methods. The working qualities of the principal hardwoods and softwoods. The causes of and the methods of preventing decay and defects in growing and converted timber. Storage methods. The manufacture of veneers, plywood, blockboard and lamin board: their advantages and disadvantages for particular purposes. The specifications for and uses of nails, screws and abrasives. The manufacture and use of glues and other adhesives. Metal fittings and fixings, e.g. locks, catches, stays, hinges, handles.

3. *Construction and processes*

All types of joint used in carcasses and frames including the secret mitre dovetail. Methods of assembly used in simple and involved frames and carcasses. The principles underlying the choice of joint for strength, resistance to stress and strain, ease of assembly and decorative effect. The veneering of flat and curved surfaces; inlaying; edge moulding and jointing. Incised lettering. The preparation of surfaces for polishing. Finishing methods and processes, including French and wax polishing, varnishing, oiling and cellulose spraying. The preparation of cutting lists and the use of the rod or skid.

II.

1. *History*

A knowledge of the principal styles of English furniture up to the present day and of their historical development. A study of the work of the master craftsmen and designers and the influence on that work of the social and economic circumstances of their times. The work and value to the community of the carpenter, joiner and cabinet maker from early English times up to the present day; the coming of the machine age and its effect upon the design and nature of their work.

The design and development of the door, window and roof truss from the fourteenth century to the present day.

2. *Drawing and Design*

The provisions of *British Standard Engineering Drawing Practice* (B. S. 308) in force on 1 September 1965 should be observed in the preparation and dimensioning of drawings.

Drawing and Design will be mainly concerned with details and design of furniture, fittings and components and of other forms of woodwork such as carpentry, equipment for the garden and smallholding and for sport. The test may require the reproduction by orthographic, isometric or oblique projection and by freehand sketches of joints and of constructional and decorative details.

Shape and form in turnery; the sectioning and form of classical mouldings and plinths.

The candidate will be required to design a piece of work from given data.

Practical Examination

The practical examination will take the form of two three-hour sessions in which the candidate will at the discretion of the examiners be tested on *either one or two* separate pieces of work. The tests will call for a high degree of accuracy of construction and finish and will be based upon a piece of household furniture or of workshop equipment or part of a building. The tests may be set in the form of dimensioned sketches, written description or scale drawing. Some part of the work may be left to the discretion of the candidate in order to test his ability to design, his sense of proportion and his knowledge of joints for particular purposes. The tests will incorporate one or more of the common joints as traditionally used in industry, and may involve the use of any of the common hand tools. Ability to design and turn a simple article on the lathe may be tested, emphasis being laid upon fitness for purpose and aesthetic appeal. Simple decoration may be required.

Specimens of work

The work done by the candidate during the last two years of the course, together with the related working drawings, must be made available for assessment by the Board's examiners.

(A 43) METALWORK (two papers each of three hours and a practical examination consisting of two parts each of three hours)

Metalwork may not be offered at the same sitting of the examination as Engineering Workshop Theory and Practice.

Candidates will be expected to possess an adequate working knowledge of the subject matter of the Ordinary syllabus in Geometrical and Engineering Drawing.

I.

1. *Materials*

Principal metals and alloys used in engineering including the following: aluminium, brass, bronze, bearing metals, copper, zinc, gilding metal, lead, tin, iron, steel. General physical and working properties of these metals, their distribution, extraction, production and forms of supply.

Thermal equilibrium diagrams for tin-lead, copper-zinc and iron-carbon; simple macro-examination; critical points. Workshop and industrial methods used in heat treatment of steel; annealing, normalising, hardening and tempering, carburising, case-hardening.

Tests of hardness and tensile strength of common metals, using simple apparatus and including an appreciation of the significance of stress-strain diagrams.

2. *Tools and Processes*

Either

(a) *(for candidates offering **hammered metalwork**)*

Use, construction and maintenance of the usual hand tools used in hammered metalwork. The special care of hammers and stakes.

Setting up of the lathe for plain and shaped turning. Use of hand turning tools and formers for turning brass, other non-ferrous metals, fibrous materials and plastics.

The brazing hearth: construction and mechanical methods of control.

Use of colouring agents to give a finish to non-ferrous metals.

Use of setting out table and measuring equipment.

Or

(b) *(for candidates offering **engineering metalwork**)*

Use, construction and maintenance of the usual hand tools used in engineering. Hand forging equipment and elementary knowledge of simple machine presses.

Main features, construction, operation, and standard equipment of the following machines.

Lathe: production of tapers, screw threads and fine limit bores; machining of simple castings; form tools including flat and circular types; rake and clearance angles and effects of variation of these angles. Simple treatment of the cutting action of lathe tools.

Drilling machine: sensitive types. Flat and twist drills, point angles; effects of faulty grinding and setting up.

Milling machines and shaping machines; production of flat surfaces, keyways, slots (including tee-slots); holding devices and fixtures normally required.

Cutting lubricants used with all the above machines.

Elementary engineering metrology; concept of length standard; methods of direct and comparative measurement.

3. History

Either

(a) (*for candidates offering hammered metalwork*)

A broad historical knowledge of the work of the goldsmith and silversmith from the time of the Anglo-Saxons, with special attention to the decorative processes used.

The rise and decline of the Craft Guilds. The introduction of the "hallmark" and its significance. The patronage of the craftsman by the Church. A description of church plate.

English leadwork with special reference to church fountains, rain water heads and cisterns. English pewter ware. Decorative wrought ironwork. The importance of church brasses and the preparation of brass rubbings. The artist craftsman and the trend in modern bronze statuary.

Or

(b) (*for candidates offering engineering metalwork*)

The development of engineering against a background of British social history from the thirteenth century to the present day. Role of the village craftsman, rise and decline of the Craft Guilds, general outline of the history of engineering in relation to industry and transport. Contributions by famous engineers since the industrial revolution. Effect of the invention of the steam engine and internal combustion engine. Development of machine tools and production methods.

Alloys for service at high temperatures; their impact on modern engineering.

II. Drawing and Design

Either

(a) (*for candidates offering hammered metalwork*)

Development of surface shapes including the oblique cone and the frustum of the cone using the method of triangulation.

Development of surface shapes resulting from the intersection of cone and cylinder.

Appreciation of form and construction. Designing pieces of hammered metalwork to serve a particular purpose in the home, workshop, school, or church.

Decorative treatment including chasing, filigree, piercing, repoussé and etching.

Suitability of fibrous materials and plastics to be used with hammered metalwork. Methods of fixing handles, knobs, lids and hinges.

Or

(b) (*for candidates offering engineering metalwork*)

A descriptive treatment of couplings, brackets, bearings (including ball and roller), spur gears, coil springs, linkages, fastenings (including rivets, bolts, screws and studs, keys and cotters). (Advanced numerical treatment will not be required but candidates will be expected to use these parts in design work using data normally found in engineering handbooks.)

Design of straight sided cams to give simple reciprocating motion.

Screw threads, profiles and applications of Whitworth, B.A., B.S.F., Unified, Acme, square and pipe thread. Projection of single and multi-start threads.

Candidates may be asked to design and prepare detailed drawings of parts to meet specified problems and conditions involving apparatus, mechanical devices and tools normally found in engineering practice.

Practical Examination

The practical examination will take the form of two three-hour sessions in which the candidate will be tested on one piece of work. The first session may include a test of the candidate's ability to design.

The practical examination may include any of the processes named in the syllabus for the written papers. In addition the following processes may be examined:

Either

(a) (*for candidates offering **hammered metalwork***)

Hollowing, raising, sinking followed by planishing.

Seamed work based on cylindrical, conical, rectangular, and polygonal shapes.

Use of graded solders for repeated hard soldering. Soft soldering.

Lathe work in chuck or between centres, turning knobs and base rings in non-ferrous metals, fibrous materials, and plastics.

Making and fixing twisted wires for decoration.

Forging and shaping simple tools for decorative work, *e.g.* chasing and punch decoration. Pierced work.

Making and fixing of hinges to constructional parts.

Or

(b) (*for candidates offering **engineering metalwork***)

Correct use of normal marking off and measuring equipment.

Scraping. Production of flat surfaces.

Hand welding.

Off hand grinding, including drill points, and lathe tools to cut simple forms.

Making of simple patterns and moulding, including use of cores.

Further work on the lathe including taper turning, screw cutting, chasing, boring, reaming, knurling, and examples requiring use of steadies, mandrels and faceplates.

Simple work on the milling machine using slotting, plain side and end cutters.

Production of flat surfaces at right angles on the shaping machine.

Specimens of work

A representative selection of the work done by the candidate during the last two years of the course, together with related working drawings, must be made available for assessment by the Board's examiners.

(A 44) GEOMETRICAL AND ENGINEERING DRAWING (two papers each of three hours)

The examiners will assume that candidates possess a knowledge of Mathematics and of Geometrical and Engineering Drawing up to the Ordinary level. It is desirable that candidates should have attended a course in Engineering Workshop Theory and Practice (or the equivalent) or should have had engineering workshop experience.

I. Geometrical Drawing

Construction of the ellipse, parabola and hyperbola and of the tangents to these curves. Construction of the helix, cycloid, epicycloid, hypocycloid, involute, Archimedean spiral and logarithmic spiral.

Simple harmonic motion; resultant locus of two component simple harmonic motions at right angles. Construction of cam profiles to give specified motion to the follower: *e.g.* uniform velocity, uniform acceleration and simple harmonic motion. Resultant of co-planar forces by the funicular polygon. Force diagrams for simple framed structures.

Isometric and oblique projection of geometrical solids and simple machine parts. Construction of involute teeth.

Projections of geometrical solids, right and oblique, in specified positions. Problems on the oblique plane. The interpenetration of solids, curves of intersection and the developments of surfaces.

II. Engineering Drawing

The provisions of *British Standard Engineering Drawing Practice* (B. S. 308) in force on 1 September 1965 should be observed in the preparation and dimensioning of all drawings and sketches.

Freehand sketching of engineering components. Preparation of detail drawings to scale from dimensioned freehand sketches and from design lay-outs. Drawing of assemblies from detail drawings.

Study of the information normally found in industrial detail drawings, and the preparation of new sets of views from these drawings.

The general form and examples of application of the following: screw threads, screws, bolts, nuts and keys; plain, ball and roller bearings; couplings, flexible joints, belts and gears; riveted and welded joints.

Study of assembly drawings of simple mechanisms: interpretation of the function of individual components and of the unit as a whole.

(A 51) HOUSECRAFT (three papers (Paper I two and a half hours, Paper II two hours, Paper III two and a half hours) and a practical examination (Paper IV) of one and a half hours plus two and a half hours)

Housecraft may not be offered at the same sitting of the examination as either Domestic Science (Ordinary) or Needlework and Dressmaking (Advanced) or Paper III in Art (Advanced).

The syllabus is not solely intended to emphasize craft skills but also to encourage individual thought, scientific application and qualities of accuracy and powers of observation. To this end it is hoped that candidates will have studied, earlier in their school careers, not only Domestic Science but in addition some of the subjects (such as Physics and Chemistry or General Science, as well as History and Geography) which are fundamental to Housecraft as it is here conceived.

I. A study of Home and Society

Study should be related wherever possible to the candidate's own environment and experience and should show evidence of some reading of contemporary sources.

Candidates will be required to answer four questions on one of the following sections:

A. Housing and Town Planning

(a) Historical review: geographical and natural resources influencing siting; concentration of population since about 1800 through expansion of trade and industry; suburban development, housing estates, satellite towns, new towns; growth of public interest in planning.

(b) Local government to-day in relation to housing and town planning: statutory powers: why these are variously applied.

(c) Some housing problems:

(i) technical: type, size and design in relation to cost;

(ii) human: houses as homes; type, size and design in relation to needs (e.g. family, old people, single women).

B. The Home: Design

Historical development from about 1800.

(a) The eighteenth-century background. The Victorian interruption. The machine age: influence on structure and pattern. The revival of handicrafts. The house in its setting.

(b) The influence of some present-day economic and social factors, such as mass-production, changes in the standard of living and the altered status of women.

(c) Materials and equipment available in the home to-day: fitness for purpose; texture; decoration; use of colour and lighting. Aims and work of organizations concerned with design e.g. the Council of Industrial Design. Consumer protection.

C. Industrial and agrarian changes from circa 1800: their effect on home life.

(a) Outline of agrarian and industrial changes as they affected the standard of life of the workers: wages and conditions of work. Relevant legislation and reform.

(b) Commercial expansion and scientific inventions as they affected

(i) material conditions of homes of various types;

(ii) physical well-being: dietary, comfort;

(iii) leisure.

(c) Position of women in the home and outside it. Developments affecting their conditions of work, their political and legal status, their standing in industry, commerce and professional life.

D. Social Services in their influence on the home and family life

(a) Historical review of the development of the statutory and voluntary social services in the twentieth century.

(b) Changes in social conditions since 1900 with particular reference to poverty, housing, the health of the family and the care of children. The general relationship of these changes to the rise of the social services.

(c) Some statutory social services:

(i) Maternity and child welfare.

(ii) Health and housing: insurance.

(iii) Cultural and recreational facilities outside school.

(iv) Care of the handicapped and deprived: pensions.

(d) Voluntary social services in support of family life; the partnership between voluntary and statutory effort and resources in the care of old and young.

II. *Elementary Science in relation to its applications to Housecraft*

1. Applied Physics

(a) Simple machines: levers, pulleys. Application to scales, mangle, clothes-rack, windows. Gas and water pressure, the barometer. Applications to water supply, stop taps, lift and force pumps, syringe, syphon, lavatory flush.

Specific gravity, hydrometers. Surface tension and simple illustrations, detergents.

(b) Temperature and thermometers: clinical, maximum and minimum; thermostatic control. Heat calorific value of foodstuffs. Effect of pressure and dissolved substances on the boiling point of liquids and on the melting point of ice; regelation; pressure cookers. Cooling by evaporation. Refrigeration.

Moisture in the atmosphere; relation to drying clothes. Conduction, convection and radiation with illustrations. Application to domestic hot water supply, ventilation, modern methods of excluding draughts, different types of fires, slow combustion stoves and grates; loss of efficiency in cooking due to scale, grease and soot. Thermos flask.

(c) Electrification by friction: conductors and insulators. Leclanché cell, dry cell, lead accumulator—care and use. Heating effect of current, fuses and fuse boxes. Magnetic effects of current; the electric bell. Practical electrical units and simple calculations, the kilowatt hour—cost of domestic supply. Domestic applications—earthing, types of plug, fittings in bath-rooms, the electric cooker, the electric washer. Dangers associated with electrical equipment, safeguards and hints on its careful use. Precautions to be taken in connection with gas, water and electricity when shutting up a house.

(d) Illumination and its efficiency, relative merits of bowls and shades, strip lighting. The spectrum, dispersion. Colour, matching materials—effect of light. Infra-red and ultra-violet radiation.

2. Applied Chemistry

(a) Temporary and permanent hardness of water—causes, measurement and removal. Constituents of soaps, soap powders and soapless detergents. Properties and uses of laundry reagents, e.g. starch, salts of lemon, paraffin, methylated spirit. Bleaching by oxidation and reduction. Physical and chemical properties of natural and man-made fibres.

(b) Chemical composition and properties of food; proteins, fats, carbohydrates, mineral matter and vitamins. Simple qualitative food analysis (excluding vitamins). Changes taking place during digestion. The composition and reaction of raising agents. Effects of acids and alkalis on common metals, and other materials used for cookery utensils, e.g. heat-resisting glass and glazed earthenware.

III. *Theory and Practice of Housecraft*

1. The Home

(a) Environment; site; soil; aspect; position in relation to public services. Growth and health of family; family relationships.

(b) Construction, including the use of modern building materials; lighting, heating and ventilation. Accommodation for the family.

(c) Furnishings—floor coverings, furnishing fabrics, wall covering, household linen. Aesthetic appreciation; arrangement of flowers. The use of colour, design and fabric. The making of simple cushions and of curtains for appropriate fittings.

(d) Equipment—cleaning, cooking, heating and lighting. Initial and running costs. Storage of movable equipment. Care and use of household equipment.

(e) Care of personal and household linen. Use of detergents.

2. (a) Wise feeding of the family—nutrition. Diets in relationship to age, work and health; planning and costing of meals; food hygiene and preservation.

(b) Physiology. Maintenance of healthy functioning of the body. The skeleton, joints and muscles; circulatory, respiratory, digestive, excretory and nervous systems.

3. (a) Planning of household work aiming at economy of time and labour. Assignment work in practical Housecraft.

(b) Household budgets for different income levels and families.

4. Home dangers connected with construction, furnishing and equipment.

Practical Examination

The practical examination will be a test on the practical aspects of the syllabus for Paper III with particular reference to Cookery, with emphasis on (a) planning, cooking and serving of meals for a variety of needs and occasions, (b) basic recipes, (c) manipulative skill. It will be in two parts with an interval of several days intervening between the parts.

In the first part of the test each candidate will be told what work she is to do in the second part and will be given one and a half hours in which to prepare a written plan of the dishes she will make (with reasons for her choice) and a list of ingredients she will require.

In the second part, some days later, she will be required to cook the dishes she has planned. Two and a half hours will be allowed for this part of the test and in this time all utensils used must be cleaned.

(A 52) NEEDLEWORK AND DRESSMAKING (three papers (Paper I two and a half hours, Paper II two hours, Paper III two and a half hours) and a practical examination (Paper IV) of two hours plus three hours)

Needlework and Dressmaking may not be offered at the same sitting of the examination as Domestic Science (Ordinary), Housecraft (Advanced), Paper III in Art (Advanced) or either of the following alternatives under Craft (Design and Practice) (Ordinary or Advanced): H. Embroidery, J. Dress.

I. A Study of Home and Society

The syllabus will be as for Housecraft (Advanced) Paper I (pages 114 and 115).

II. *Elementary Science in relation to its applications to Needlework and Dressmaking.*

1. Applied Physics

(a) Simple machines: levers, pulleys. Application to scales, mangle, clothes-rack, windows.

Specific gravity, hydrometers. Surface tension and simple illustrations, detergents.

(b) Temperature and thermometers: clinical, maximum and minimum; thermostatic control. Cooling by evaporation.

Moisture in the atmosphere; relation to drying clothes. Conduction, convection and radiation with illustrations.

(c) Electrification by friction: conductors and insulators. Leclanché cell, dry cell, lead accumulator—care and use. Heating effect of current, fuses and fuse boxes. Magnetic effects of current; the electric bell. Practical electrical units and simple calculations, the kilowatt hour—cost of domestic supply. Domestic application—earthing, types of plug, fittings in bath-rooms, cookers, washers, sewing machines and irons. Dangers associated with electrical equipment, safeguards and hints on its careful use. Precautions to be taken in connection with gas, water and electricity when shutting up a house.

(d) Illumination and its efficiency, relative merits of bowls and shades, strip lighting. The spectrum, dispersion. Colour, matching materials—effect of light. Infra-red and ultra-violet radiation.

2. Applied Chemistry

Temporary and permanent hardness of water—causes, measurement and removal. Constituents of soaps, soap powders and soapless detergents. Properties and uses of laundry reagents, e.g. starch, salts of lemon, paraffin, methylated spirit. Bleaching by oxidation and reduction.

3. Fabrics

Study of fibres and filaments, vegetable, animal and man-made: origins, physical and chemical properties.

Processing of fibres. Manufacture of filaments, yarns and fabrics. Finishing of yarns and fabrics to include bleaching, dyeing, printing and modern finishes.

III. *Theory of Needlework and Dressmaking*

1. History.

A study of **one** of the following periods of English Dress:

- (a) Georgian,
- (b) Victorian.

2. Fashion study and wardrobe planning.

Selection and styling of clothing suitable for various occasions for

- (a) boys and girls from 1—10 years,
- (b) schoolgirls from 10—18 years.

The study of fashion trends. The value and choice of accessories. Good grooming.

3. The purchasing of material, tools and equipment.

The choice, care and handling of fabrics for under and outer garments, household linens and soft furnishing items.

The purchase of materials, approximate prices and quantities.

The choice, purchasing, care and use of the tools for home dressmaking.

4. Drafting, use of commercial patterns.

A knowledge of bodice, sleeve and skirt blocks to be used in the adaptation of commercial patterns for boys and girls of 1—10 years and schoolgirls of 10—18 years for blouses, children's garments, dresses, simple coats and suits, lingerie. Re-styling.

Fitting—study of shape, size and posture.

Figure irregularities.

5. Assembly, fitting and construction of garments.

The planning, cutting out and making up of children's wear, lingerie and outer garments. The suitability and use of hand sewing and embroidery in the making up and decoration of (a) children's wear and (b) lingerie (including blouses). The choice and use of modern decoration for outer garments.

6. Care of clothes.

Valuing and general repairs.

7. **Either**

(a) Embroidery. A study of the design and execution of contemporary embroidery (hand or machine).

Or

(b) Soft furnishings. The choice of colour, design and fabrics for soft furnishings in relation to the general scheme of decoration. Estimating, cutting and making up of curtains, pelmets (stiffened), cushions and padded quilts.

Practical Examination(a) *Practical test*

The test will be based on §§ 4 and 5 of the syllabus for Paper III.

The first part, of two hours duration, will be held on a specified date when details of the whole test will be supplied to candidates.

The second part, of three hours duration, will be held on dates to be arranged by the Board; the examiner will be present at this session. At the end of the session candidates will be required to put on, for the examiner's inspection, the garments made during the course under (b) (i) below.

(b) *Course work*

From the practical work attempted during the course, the following must be submitted for inspection by the examiner:

- (i) A woollen dress or simple suit to fit the candidate.
- (ii) **Either** lingerie **or** a blouse **or** a child's dress showing some hand work.
- (iii) **Either** an embroidered item, hand or machine, **or** a household or furnishing item.

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1. **Research Methods and Sampling Procedures.**
The procedure, including but not limited to, the selection of research instruments, the development of a sampling plan, the selection of the population to be studied, and the design of the sampling instrument are all discussed.

2. **Data Collection.**
A discussion of the various methods of data collection is presented.

3. **Tables**

(a) **Frequency Tables.** A study of the various types of frequency tables and the methods of their construction is presented.

(b) **Grouped Frequency Tables.** The theory of grouped frequency tables and the methods of their construction are discussed. The general theory of continuous, discontinuous, and mixed series is also discussed.

4. **Statistical Inference**

(a) **Descriptive Statistics.**

This part will be based on the material in the chapters on Tables 11-13. The first part of this section, dealing with the various statistical tests of the mean, will be covered in detail.

The second part of this section, dealing with the various tests of the variance, will be covered in detail. The third part of this section, dealing with the various tests of the correlation coefficient, will be covered in detail.

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(b) **Comparative Statistics.** This part will be based on the material in the chapters on Tables 14-16. The first part of this section, dealing with the various statistical tests of the difference between two means, will be covered in detail. The second part of this section, dealing with the various tests of the difference between two variances, will be covered in detail. The third part of this section, dealing with the various tests of the difference between two correlation coefficients, will be covered in detail.

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