

HONG KONG
ENGLISH SCHOOL CERTIFICATE SYNDICATE

HANDBOOK
OF
REGULATIONS AND SYLLABUSES
FOR THE
ENGLISH SCHOOL CERTIFICATE EXAMINATION

1968

PRINTED AND PUBLISHED BY THE GOVERNMENT PRINTER
HONG KONG
1967

**THE HONG KONG ENGLISH SCHOOL CERTIFICATE
SYNDICATE 1966/67**

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**HONG KONG ENGLISH SCHOOL
CERTIFICATE EXAMINATION
1968**

CONTENTS

	<i>Page</i>
REGULATIONS	1
SYLLABUSES—	
English Language	6
Chinese Language and Literature	7
French, Portuguese and Other Approved Modern Languages	9
English Literature	10
Chinese History	13
Geography	15
History	17
Biblical Knowledge	24
Economic and Public Affairs	26
Mathematics, Syllabus A	31
Additional Mathematics	38
General Science and Additional General Science	40
Physics	57
Chemistry	63
Biology	79
Domestic Subjects	85
Music	89
Art	95
Pottery	98
Embroidery	99
Woodwork	101
Metalwork	103
Practical Electricity	105
Technical Drawing	108
Dressmaking	109
Principles of Accounts	111
Typewriting and Shorthand	112
Elementary Chinese	114
APPENDIX—	
Mathematics, Syllabus B (for introduction in 1969)	115

HONG KONG SCHOOL CERTIFICATE
EXAMINATION

1968

SYNDICATE
COMMITTEE

REGULATIONS

for the

HONG KONG ENGLISH SCHOOL CERTIFICATE EXAMINATION, 1968

Section I—Introduction

1. The examination is intended as a test of general education for students who have completed a recognised Anglo-Chinese Secondary School course of five years duration. The Certificate is awarded to show a satisfactory standard of general education.
2. The standard of a "Pass with Credit" in each subject is recognised by the University of Hong Kong, the University of London and some other overseas universities as equivalent to a pass at Ordinary Level in the examination for General Certificate of Education as conducted in England.
3. The examination is conducted annually according to these regulations by the Hong Kong English School Certificate Syndicate acting through its Board of Control in accordance with the provisions of its constitution.
4. The examination is normally held about the first week in June.
5. At least one month before the commencement of the examination the Secretary shall issue :
 - (a) examination time-tables
 - (b) notice of the centres at which the examination is to be held.

Section II—Participation in the Examination by Schools

1. Schools wishing to participate in the examination for the first time, or to enter candidates for a practical subject (see Section V, Para. 1) not previously taken, shall make application to the Secretary for approval not later than 1st February, 16 months preceding the date of the examination concerned.
2. All such applications shall be referred by the Secretary to the Director of Education, who will decide whether a school shall participate and if so, whether there should be any limitation on practical subjects taken.

3. The Secretary shall inform such schools of the decisions of the Director not later than 31st May in the year preceding the examination.

4. The number of candidates entered by participating schools shall be subject to control by the Director of Education.

5. Not later than 31st May in the year preceding any examination the Secretary shall inform all participating schools of the basis on which to calculate the number of candidates they are permitted to enter as decided by the Director.

6. Only *bona fide* members of Form V, or, in certain circumstances to be specified by the Director of Education, of Form VI, may take part in the examination as school candidates.

7. Schools presenting candidates for this examination shall place their staff at the reasonable disposal of the Syndicate and the Director of Education as required for the purposes of the examination.

8. Schools presenting candidates for this examination shall similarly make their school buildings and facilities available to the Syndicate and the Director of Education for such purposes of administration and/or examination as may be required.

9. All participating schools must be prepared to provide, as required by the Director of Education, acceptable desks and chairs for the number of candidates they present.

Section III—Participation in the Examination by Private Candidates and Mature Students

1. Students who already hold a statement showing passes in at least five subjects at one and the same H.K.E.S.C. Examination or equivalent may with the approval of the Board of Control enter for a subsequent examination as private candidates. (Students who have passed in any five subjects previous to 1965 may also apply to participate in the examination as private candidates.)

2. Students over 25 years of age on 1st January, 1968 may participate in the examination as private candidates subject to such conditions as the Board of Control may impose.

3. Private candidates must satisfy the Board of Control that they have completed a satisfactory course for each of the subjects offered.

4. They shall obtain from and return to the Secretary, before 1st October, 1967, a form applying for approval of their participation in the examination.

5. Notification of approval and arrangements for paying entry fees shall be forwarded by the Secretary before 9th November, 1967.

Section IV—General Arrangements

1. The Secretary shall issue about 1st October, 1967, the appropriate entry forms to schools that have been approved for participation.

2. Entry forms from schools shall be returned to the Secretary before noon on 4th November, 1967.

3. Late entries may be accepted up to two weeks after this date on payment of a late entry fee of \$5 per candidate. Late entries for the 1968 Examination will be accepted up to noon on 18th November, 1967. After this date no entry shall be accepted.

4. The Secretary shall notify schools of arrangements for payment of fees not later than 9th December, 1967.

5. Four identical photographs ($2'' \times 2\frac{1}{2}''$) of each candidate shall be supplied and shall have been taken within the last six months.

6. The entry fees are now under consideration. Schools will be informed by circular in due course.

7. All participating schools are allowed a maximum reduction of 10% of total entry fees to assist in defraying the entry fees of needy students.

8. Candidates offering languages other than those named in Section V below shall pay an additional fee of \$25 for each such language.

9. All correspondence shall be addressed to the Secretary. Any enquiries on behalf of a school candidate shall be sent through the Head of his school.

10. The Board of Control at its discretion may disqualify a candidate who breaks any of these Regulations or any instruction for the conduct of the examination.

Section V—Subjects of the Examination

1. The subjects of the examination shall be :

English, Chinese, French, Portuguese, Urdu, and such other languages as may be approved by the Syndicate, English Literature, Chinese History, Geography, History, Biblical Knowledge, Economic and Public Affairs, Mathematics, Additional Mathematics, General Science*, Additional General Science*, Physics*, Chemistry*, Biology*, Domestic Subjects*, Music, Art, Pottery*, Embroidery*, Woodwork*, Metalwork*, Practical Electricity*, Technical Drawing*, Dressmaking*, Principles of Accounts, Type-writing and Shorthand*, Elementary Chinese. (Those marked with an asterisk are considered to be practical subjects for purposes of Section II, paragraphs 1 - 3.)

2. Not more than nine subjects shall be offered at one examination and no candidate shall offer :

- (a) Physics, Chemistry, or Biology in addition to General Science.
- (b) Additional General Science without General Science. (Unless the candidate has passed in General Science at the previous examination.)
- (c) Both the Needlework Section of Domestic Subjects and Dress-making.
- (d) Any subject for which his school is not permitted to enter a candidate. (In exceptional circumstances where application is made before 1st October, 1967, the Board of Control where it is satisfied that a suitable course has been followed, may grant permission for a candidate to offer Music or any subject which does not have a practical examination.)

3. Elementary Chinese shall count as a full subject towards the 9 subjects mentioned in Para. 2 above but a pass in this subject shall not count towards the award of a School Certificate (Section VII, Para. 2).

Section VI—Standards in Individual Subjects

1. Performance in individual subjects shall be assessed in eight grades which correspond to four categories :

Grade A	(Pass with Distinction)
Grades B & C	(Pass with Credit)
Grades D & E	(Pass)
Grades F, G & H	(Fail)

Section VII—Conditions for the Award of a Certificate

1. A statement shall be issued to each candidate, which shall show the grade obtained in each subject examined.

2. A School Certificate shall be awarded to a candidate who has obtained at one and the same examination either a Pass in English Language and in at least four other subjects *OR* a Grade F in English Language and a Pass in at least five other subjects.

The subjects passed must include :

- (a) A second approved language *OR* one of the following subjects : English Literature, Chinese Language and Literature, Chinese History, Geography, History, Economic and Public Affairs, Biblical Knowledge.

(b) One of the following subjects : Geography, Mathematics, Additional Mathematics, General Science, Physics, Chemistry, Biology, Domestic Subjects.

The Certificate shall show the grade obtained in every subject passed.

3. A Certificate of Ordinary Level Passes shall be issued to a candidate who has obtained Grade C or above in one or more subjects in the examination.

The Certificate shall show the grade obtained in every subject passed at Grade C level or above.

4. Where a candidate qualifies for the award of both a School Certificate and a Certificate of Ordinary Level Passes a composite certificate shall be issued.

Section VIII—Publication of Results

1. The preliminary Pass List for the examination will normally be published before 15th August. It will show the numbers and names of all candidates who have qualified to receive a School Certificate.

2. At the same time each school shall receive a Full Results List, which will indicate the grade reached in each subject offered by the candidates from that school.

3. A Statement of Results shall be issued to each candidate as soon as possible thereafter.

4. Certificates shall be issued as soon as possible after Statements of Results are issued.

5. A copy of the Annual Report of the Board of Control will be sent to the Heads of all participating schools as soon as possible after its adoption by the Syndicate.

SYLLABUSES

ENGLISH LANGUAGE

There will be three sections: I Composition, II General English, and III Oral. Candidates must pass in the aggregate of the three sections.

I. Composition

A composition paper of 1½ hours will be set. Candidates will be required to write ONE essay of not less than 400 words. A choice of subjects will be given, which may include narrative, descriptive, factual and imaginative topics or argument. Account will be taken of the subject matter, arrangement, and of the command of English.

II. General English

One paper of 2 hours will be set. There will be three sections, which will be compulsory.

- A prose passage of not more than 600 words will be set. Candidates will be asked to summarize either a part or the whole of the meaning in a given number of words, to be not more than 150.
- A prose passage, or passages, will be set to test comprehension of content and language.
- Questions will be set on various aspects of English usage. Candidates may also be asked to write a short letter. Questions on formal grammar will not be set.

III. Oral

- Reading*:—Candidates will be required to read aloud a prose passage chosen by the examiners.
- Conversation*:—Candidates will be expected to hold a short conversation with the examiners.

Note: There will be no General Reading Paper but the study of language should be linked directly with the reading of well written books, and an adequate course of such reading should be followed.

CHINESE LANGUAGE AND LITERATURE

The examination will consist of two papers. Pen and ink may be used in the examination instead of the Chinese writing brush. Candidates may write in the literary style or in Kuo Yu as they choose.

Paper I. Chinese Language (2½ hours)

The paper will be divided into three parts:

- Part 1—the writing of an essay;
- Part 2—the writing of a letter or article for practical or everyday use;
- Part 3—either (i) paraphrasing one or more unseen passages from the literary style into the colloquial style (Kuo Yu) without any choice or (ii) answering questions on one or more unseen passages written in the literary style or colloquial style (Kuo Yu) without any choice.

Paper II. Literature (2½ hours)

Questions from prescribed texts. Questions will be set on the content and style of the texts concerned, including exposition of the meaning and paraphrase of different passages in the literary style or in Kuo Yu and on the background of the texts, including authorship, date, and the relationship of the texts to the age in which they were written.

文選篇名	作或者編者	文選篇名	作或者編者
1. 詩三篇 蓼莪 蒹葭 東山	詩經	7. 張衡傳(節錄) 「張衡字子平……尤致思於天文陰陽歷算」	後漢書
2. 晉敗秦師於殽	左傳	「安帝雅聞衡……作應闇以見志云」	
3. 論語 論學 論孝 論仁 論君子	論語	「陽嘉元年……地動所從方起」	
4. 孟子 論四端 論義利 離婁章(孟子曰：「離婁之明至「吾君不能謂之賊。」)	孟子	「初光武善讌……乃上疏曰」	
5. 倭文篇	荀子	「此皆欺世罔俗……以宣寄情志」	
6. 秋水 「秋水時至」至「至大之域。」	莊子	「自漢取秦……起於哀平之世也」	
		「永和初出為河間相……永和四年卒」	
		「所著書……凡三十二篇」	

文選篇名

作或者
編者

文選篇名

作或者
編者

8. 古詩十九首（選五首） 行行重行行 涉江采芙蓉 西北有高樓 庭中有奇樹 東城高且長	（佚名）	19. 蘇辛詞選 念奴嬌 赤壁懷古 永遇樂 京口北固庭懷古	蘇軾 辛棄疾
9. 出師表	諸葛亮	20. 宋賢語錄選 通書 文辭 語類 學校	周敦頤 朱熹
10. 贈白馬王彪並序	曹植	21. 正氣歌並序	文天祥
11. 歸園田居三首	陶潛	22. 東籬樂府選 小令二：雙調、撥不斷 套數一：般涉調哨箏	馬致遠
12. 小國賦	庾信	23. 明儒學案凡例	黃宗羲
13. 送孟東野序	韓愈	24. 六書論序	戴震
14. 始得西山宴遊記	柳宗元	25. 答林琴南書	蔡元培
15. 李杜詩選 宣州謝朓樓餞別校書叔雲 北征	李白 杜甫	26. 國語與國文	羅庸
16. 虬髯客傳	杜光庭		
17. 江鄰幾文集序	歐陽修		
18. 答司馬諫議書	王安石		

Note: Following is a Recommended Reading List to help in the preparation of candidates for the examination in Chinese Language and Literature (the passages are from "Selections from Chinese Literature, Vol. 1", University of Hong Kong, 香港大學『中國文選』上編; candidates, however, will not be examined on their contents):—

1. 小戴禮記：三年問
2. 大戴禮記：曾子大孝
3. 管子：牧民
4. 荀子：勸學
5. 韓非子：定法
6. 公孫龍子：白馬論
7. 屈原：哀郢
8. 司馬相如：長門賦
9. 王粲：登樓賦
10. 鄭道元：水經江水注
11. 歸有光：項脊軒志
12. 徐宏祖：遊廬山日記
13. 汪中：漢上琴臺之銘
14. 李商隱：無題
15. 韋莊：秦婦吟
16. 黃庭堅：登快閣
17. 陸游：太息
18. 李煜：浪淘沙，相見歡
19. 周邦彥：六醜
20. 姜夔：揚州慢
21. 辛棄疾：菩薩蠻
22. 馬致遠：秋思
23. 王實甫：哭宴
24. 關漢卿：題情
25. 白樸：梧桐雨
26. 紀君祥：趙氏孤兒
27. 孔尚任：餘韻
28. 洪昇：彈詞
29. 施耐庵：林沖
30. 吳承恩：孫悟空
31. 曹雪芹：劉老老
32. 劉鶚：桃花山下遇虎

FRENCH, PORTUGUESE AND OTHER APPROVED MODERN LANGUAGES

The examination will take the following form:

I. Written Paper (Time, 2½ hours)

Candidates will be required to sit for a paper consisting of these sections:

1. Translation from the language into English of an extract of simple prose of about 200 words.
2. Translation from English into the language of an extract of English prose, about 200 words in length, containing simple, common idioms.
3. Composition of about 200 words. 4 subjects will be given from which the candidate will choose one.
4. Comprehension of a given extract of prose. Ten questions will be set in the language on the subject matter contained in the extract. Answers must be given in the language in the tense of the question. No questions on formal grammar will be set.

II. Dictation

A short piece (about 100 words) of simple prose will be given.

Candidates are expected to know the terms of punctuation in the language.

III. Oral

1. *Reading*:—Candidates will be required to read aloud a short passage, chosen by the examiner. Attention will be paid to accent and intonation.
2. *Conversation*:—Candidates will be expected to answer, in the language, questions asked by the examiner on the extract read and to converse simply with the examiner.

ENGLISH LITERATURE

One paper of 2½ hours will be set. The paper will consist of three sections all of which must be attempted. There will be a choice of questions in each.

I. Shakespeare

Two plays by Shakespeare will be set. Candidates must choose ONE play. A compulsory context question will be set and candidates must also answer one essay question.

II. Poetry

One question to be answered.

III. Prose

Candidates must answer two questions showing a knowledge of two books.

Books for 1968

SECTION I

EITHER (i) Shakespeare: *Macbeth*

OR (ii) Shakespeare: *The Merchant of Venice*

SECTION II

Candidates must answer only ONE question, to be chosen from one of three parts. Parts 1 and 2 will each offer a choice of questions.

(i) The following poems found in the Albatross Book of English Verse (Collins):

Lord Randal

There is a garden in her face

Campion

Batter my heart, three-personed God

Donne

Care-charming Sleep

Fletcher

The Pulley

Herbert

The Instruments

Dryden

(from St. Cecilia's Day Ode)

Rape of the Lock, Canto III

Pope

(from 'Close by those meads'

to 'the rich brocade')

The Deserted Village

Goldsmith

(from 'Sweet was the sound'

to 'had his claims allowed')

The Fly	Blake
The Sunflower	Blake
The Sick Rose	Blake
Character of the Happy Warrior	Wordsworth
Ocean (from Childe Harold IV)	Byron
Ozymandias	Shelley
The Eagle	Tennyson
Blow, Bugle, Blow	Tennyson
Ode on Melancholy	Keats
My Last Duchess	Browning
The Oxen	Hardy
Pied Beauty	Hopkins
Wild Swans at Coole	Yeats
Patterns	Amy Lowell
The Grey Squirrel	Humbert Wolfe
Song for Simeon	T. S. Eliot
The Rival	Sylvia Warner
Zulu Girl	Roy Campbell
The Fish	Elizabeth Bishop

(ii) The following selection of twentieth century poems found in the Albatross Book of English Verse (Collins):

When you are old	Yeat
Mr. Flood's Party	Robinson
The Hermit	Davies
Time, you old gypsy man	Hodgson
The Listeners	de la Mare
The Donkey	Chesterton
Patterns	Amy Lowell
Home Burial	Frost
Stopping by woods on a snowy evening	Frost
Sea-Fever	Masefield
Four Preludes on Playthings of the Wind	Sandburg
The Grey Squirrel	Wolfe
The Rear Guard	Sassoon
Still Falls the Rain	Edith Sitwell
Silence	Marianne Moore
The Fish-Hawk	Wheelock

Hurt Hawks	Jeffers
Parting, without a sequel	Ransom
Anthem for Doomed Youth	Owen
The Zulu Girl	Campbell
Sunday Morning	MacNeice
Who's Who	Auden
Elegy for Jane	Roethke
An Elementary School Classroom in a Slum	Spender
The Fish	Elizabeth Bishop
Do not go gentle into that good night	Thomas
After the Last Bulletins	Wilbur

(iii) An unseen poem.

In all three parts candidates should be able to *discuss* the thought and feelings in the poems, and the way in which they are conveyed to the reader.

SECTION III

Candidates must answer ONE question on a book from part (i), and ONE question on a book from part (ii).

(i) EITHER Eliot: *Silas Marner*

OR Goldsmith: *The Vicar of Wakefield*

(ii) Forrester: *The Ship*

Twentieth Century Short Stories (Barnes & Egforde. Harrap)

Shaw: *The Devil's Disciple* (excluding the preface)

Bolt: *A Man for all Seasons.*

CHINESE HISTORY

The examination will consist of ONE paper of 3 hours duration.

One compulsory question on fundamental knowledge of Chinese History will be set. Candidates must also answer one question each from the following 4 sections. There will be a choice of questions in each section.

(1) 上起夏商，下至清季，各代遞嬗之經過與轉變大勢，注意研求其因果關係，著重歷史進程。

(2) 各代京都、重要城邑與地方行政制度之沿革，注意其建置原因及利弊得失（必要時可使用簡畧地圖，以說明史事與空間之關係）：

(一) 各代京都。

(二) 重要城邑：咸陽、陽翟、郢、臨淄、洛陽、邯鄲、宛、成都、定陶、河西四郡、許、江陵、京口、登州、揚州、廣州、泉州、大同、寧波、上海、天津、旅順、沙市。

(三) 地方行政制度：秦、漢及唐、宋、元、明、清地方政制之大畧演變。

(3) 重要歷史人物，注重其行誼與影響：

(一) 對政治、武功及交通有重要影響者，例如：周公（姬旦）、商鞅、張騫、竇憲、班超、諸葛亮、法顯、魏徵、王安石、鄭和、戚繼光、鄭成功、林則徐、慈禧太后（那拉氏）、孫中山。

(二) 對文化、學術及科學有重大貢獻者，例如：孔子、老子、墨翟、韓非、董仲舒、司馬遷、班固、張衡、鄭玄、王弼、玄奘、韓愈、沈括、朱熹、李時珍。

(4) 各代大事及其影響，注意分析比較其因果：

(一) 夏之文化、商之文化。

(二) 西周之封建與政治、禮教、宗法制度與田制。

(三) 春秋戰國社會經濟之劇變、學術思想之發達。

(四) 秦之創制與建設，及秦末劉項爭雄。

(五) 兩漢政治、經濟、學術、宗教與選舉制度；王莽之政制、士風與黨綱、外戚與宦官、黃巾之亂、州郡割據。

(六) 官渡之戰，赤壁之戰，三國鼎立與紛爭。

(七) 八王之亂、五胡亂華、淝水之戰。

(八) 南朝士族之清談與門第制度、北朝之華化、佛教之盛行。

(九) 隋之建設。

(十) 貞觀之治、武韋之亂、安史之亂、朋黨與宦官、藩鎮之亂、黃巢之亂。唐之科舉、稅制、兵制、交通、武功、文藝與宗教。

(十一) 宋代中央集權、北宋之變法與黨爭、宋與外族之關係、宋代之理學學派及文學。

- (十二) 蒙古三次西征、東西文化交流、元之統治政策。
- (十三) 明初之政治、靖難之役、明之科舉、稅制、海外交通、宦官社黨、理學、倭寇、教士之東來與西學之傳入。
- (十四) 南明抗戰、三藩之亂、清代之統治政策、清初之武功、鴉片戰爭、太平天國始末、甲午之戰、洋務運動、戊戌維新、列強之勢力範圍、義和團與八國聯軍、同盟會與辛亥革命、清代之學術。

GEOGRAPHY

The examination will consist of two papers.

Paper 1 will be of 2 hours duration. This paper will consist of *one* compulsory question in Section A on Mapwork, and *three* questions from Section B on the geography of Asia in general, with an emphasis on the regional geography of Monsoon Asia.

Paper 2 will be of 2 hours duration and candidates will be required to answer *two* questions from Section A on the Elements of Physical Geography and *two* questions from Section B on the Elements of World Human Geography.

General Comments

All questions will carry the same number of marks.

Questions on a world outline map and on the interpretation of geographical photographs may be set.

The syllabus is based on the assumption that not less than *two* hours per week over a course of *two* years will be allocated to the specific teaching of this examination syllabus, and it is recommended that this two year course follow an adequate preparation, where possible, of at least two hours per week over the previous three years.

Candidates should bring graduated rulers, protractors, coloured pencils, etc. to the examinations.

Candidates will be expected to have a first hand knowledge of the Geography of Hong Kong, and additional credit will be given for the application of this knowledge in the examination.

Candidates will be expected to draw sketch maps and diagrams to illustrate their answers where appropriate.

Paper 1 (2 hours) Mapwork and Regional Geography

Mapwork. Map reading and interpretation based on a contoured extract of Hong Kong on a scale of 1:25,000 or 1:100,000 together with the local Land Utilisation map. The necessary background theoretical knowledge of such aspects as direction, grid references, scales and representative fractions, conventional signs, methods of showing relief and height, gradients, section drawing and intervisibility, common landforms and evidence of man's activities including settlement types will be assumed.

Note: Schools with stocks of 1:20,000 and 1:80,000 topographical maps will find that these maps are still suitable for examination preparation.

Regional Geography of Monsoon Asia. A general knowledge of the continent of Asia as a whole with a more detailed knowledge of Monsoon Asia consisting of India, Pakistan and Ceylon; Burma, Thailand, Cambodia, Vietnam and Laos; Malaysia, Singapore and Brunei, Indonesia and the Philippines; Hong Kong, China (China Proper and its Outer Territories), Korea and Japan. There should be a particular emphasis on Hong Kong and China.

Paper 2 (2 hours) Elements of Physical Geography and World Human Geography

Elements of Physical Geography. The earth as a planet in the solar system. The rotation and revolution of the earth, the theory of the seasons, day and night, latitude, longitude and time.

Weather, climate and natural vegetation. Simple weather study based on local observations of temperature, pressure and rainfall. A study of local weather charts. Climate and the chief factors determining it. The major types of climate, their characteristics and distribution. The nature and distribution of natural vegetation including its correlation with climate.

Surface movements of water in oceans and seas, omitting theories of tides.

Main rock types. Major landforms and the agencies modifying them, the relief and surface features of the continents.

Elements of World Human Geography. Human occupations and activities, (particularly agriculture, forestry, fishing, mining, industry and commerce), in relation to the above physical conditions.

World trade and the distribution of the major resources:
cultivated crops (particularly wheat, rice, maize, tea, coffee, cocoa, cotton, jute, sugar cane, sugar beet and rubber),
domestic animals (particularly cattle and sheep),
sources of power (particularly coal, oil, water and atomic power),
minerals (particularly iron, tin, copper, bauxite and gold).

The distribution of population and the growth of great cities and ports.

The chief communications by sea, land and air.

HISTORY

The Syllabus is a general guide to the ground to be covered.

Candidates will be required to answer five questions from any TWO sections of EITHER Paper 1 OR Paper 2. Eight questions will be set on each section. In Paper 2, Section A, at least one question will require a knowledge of the history of Hong Kong. The duration of the examination will be 3 hours. No additional time will be allowed for reading the paper.

Paper 1

A

CHINA, JAPAN AND SOUTH-EAST ASIA, c. 1500—1793

1. China: The Ming Empire—its extent and government c. 1500—frontier conditions; conditions in Japan c. 1500—Chinese and Indian influences.
2. China in the sixteenth century: system of government—changes and opposition; economic conditions and reforms; literary and artistic achievements.
3. Japan in the Epoch of the Warring Country; rise of the Tokugawa; reorganization of government; relations with the West; relations with China—invasion of Korea.
4. Early history of the Manchus—relations with the Mings; internal discontent in China; founding of the Ch'ing dynasty.
5. Social and economic conditions in Japan under the Tokugawa; rise of capitalism; cultural developments; Confucian and Dutch influences.
6. Manchu pacification and government of China; Ch'ing expansion; social and economic conditions; literary and artistic achievements.
7. Contact of China with the West: the Portuguese; the Jesuits; the Russians; Dutch, British and other traders.
8. Burma: the Toungu dynasty; relations with neighbouring states; unification in eighteenth century.
9. The Indo-Chinese Peninsula and Siam: the states of Tonkin, Champa, Annam, Cambodia and Siam and their relations with one another.
10. Java in the sixteenth century; Dutch trade, conquest and administration; Chinese immigration.
11. European expansion in South-east Asia: rise and decline of Portuguese influence; the Spanish in the Philippines; extension of Dutch and British trade and influence.

B

EUROPE, c. 1500—1789

1. The New Monarchy; the Holy Roman Empire; the Papacy; the Italian city states; the new statecraft and diplomacy.
2. New learning and art; scientific discoveries and technical advances.
3. Economic expansion and exploration.
4. Reformation: conditions within the Church c. 1500; relations between Church and State; the influence of the new learning; Counter-Reformation; effects of Reformation.
5. Rise of Hapsburgs; Spain in the sixteenth century; civil war in France and consolidation of France; Thirty Years' War.
6. The Age of Louis XIV: domestic and foreign policies.
7. The Rise of Prussia.
8. The Rise of Russia; dismemberment of Poland; decline of Ottoman Empire.
9. Economic expansion: Mercantilism—Navigation Acts; struggle for colonies; trade wars.
10. Scientific developments: industrial techniques and scientific experiments; popularisation of scientific ideas.
11. 18th century enlightenment and reason; the Enlightened Despots.
12. Reactions against the 'Old Colonial System'; the American Revolution.
13. The French Revolution, 1789: pre-revolutionary conditions; causes of Revolution; events of 1789.

C

ENGLAND, c. 1485-1714

Generally speaking, foreign affairs (including Ireland) should be dealt with only where they play an important part in domestic policy or where a background knowledge is necessary.

1. Conditions in England, c. 1485.
2. Henry VII: his aims, methods and achievements.

3. Henry VIII: the English Renaissance and Reformation; developments in system of government.
4. Edward VI: political and religious changes and their effects.
5. Mary I: religious and foreign policies and their effects.
6. Elizabeth I: religious, domestic and foreign policies.
7. Social and economic problems under the Tudors; cultural achievements; life of the people.
8. James I: difficulties with Parliament.
9. Charles I: conflict with Parliament; Personal Government; Civil Wars—their immediate and long-term effects.
10. The Interregnum: ferment of political and religious ideas; Cromwell's attempts to find a constitutional basis for his government; Puritan England—its importance and legacy.
11. Charles II: the Restoration Settlement; religious, political and foreign problems and policies.
12. The Revolution of 1688, its character and significance; changes in the relationship between king and parliament and growth of political parties; the Act of Union; the beginning of the struggle with France.
13. Social and economic developments, cultural achievements, life of the people under the Stuarts.

D

EXPANSION OF EUROPE, c. 1500-1783

1. The Mediterranean and trade between East and West; reasons for exploration.
2. The Portuguese and Spaniards as pioneers: their debt to the Arabs; development of maps and charts and methods of navigation.
3. Discovery of the New World and Spanish conquests; the English privateers.
4. The rise and decline of Portuguese interest in the East; Western contacts with China and Japan in the sixteenth and seventeenth centuries.
5. British settlements in America and their government; the West Indies.
6. Spanish and Portuguese civilization in the Americas.

7. Mercantilism and the Colonial system; development and importance of the Slave Trade.
8. The growth of Dutch influence in the East; the European trading companies in the East.
9. Rivalry between the French and British in North America and India.
10. The growth of trade between Europe and China in the eighteenth century.
11. The expansion of Russia in Asia.
12. Events leading to the independence of the English Colonies in North America.

Paper 2

A

CHINA AND JAPAN, 1793-1941, AND HONG KONG, 1841-1941

1. Ch'ien Lung and the extent of the Ch'ing Empire; conditions of trade in China; Chinese attitude to West.
2. Japan under the Tokugawas: isolation; system of government; social and economic conditions.
3. Causes and results of the First and Second Anglo-Chinese Wars; foundation and early development of Hong Kong.
4. Relations between China and the Western powers, 1860-94: the T'ai P'ing Rebellion; the Imperial Maritime Customs; the Chefoo Convention; Russian and French expansion in the Far East.
5. The opening of Japan to the West; the Meiji Restoration.
6. China's response to the West: the Self-strengthening movement; the Hundred Days' Reform.
7. Development of Japan towards a modern state: military, political, constitutional, judicial, religious, social, economic and educational changes.
8. Causes and results of the Sino-Japanese War; the scramble for concessions; the 'Open Door' policy; the Boxer Uprising; causes and results of the Russo-Japanese War.

9. The Manchu reform programme; Dr. Sun Yat Sen and his ideas; the Chinese Revolution.
10. The development of the Colony of Hong Kong, 1860-1941: distribution and composition of population; living conditions; development of trade, education, medical services and public works.
11. China, Japan and the First World War; the Twenty-one Demands; the Versailles and Washington Conferences.
12. Japanese nationalism and Sino-Japanese relations from the Washington Conference to 1941.

B

EUROPE, 1814-1939

1. The Vienna Settlement; the Congress System.
2. Reactionary and liberal movements in Europe to 1848.
3. Unification of Italy.
4. France: Second Republic; Second Empire; establishment of Third Republic to 1879.
5. Unification of Germany and establishment of German Empire, 1871.
6. The Eastern Question.
7. Russia, attempted reforms: economic developments; revolutionary movements to 1917.
8. Laissez-faire; socialist ideas in France, Germany and Russia.
9. Economic developments (mainly in France and Germany).
10. Colonial rivalry in Africa and the Far East.
11. System of alliances; international rivalry; crises preceding the First World War; the Peace Treaties.
12. International co-operation: Alabama arbitration; the Hague Conferences; the League of Nations, its organization and early achievements.
13. Russia: the 1917 Revolutions; foreign intervention; internal changes.
14. Germany and Italy between the two wars: rise of totalitarian governments; prelude to Second World War.
15. Life of the people in Western Europe, social changes, scientific and cultural ideas and developments.

C**GREAT BRITAIN, 1814-1939**

1. Economic, social and political conditions in England, c. 1814.
2. Major industrial and agricultural developments in the nineteenth century; economic ideas.
3. Social and political discontent after the Napoleonic wars; liberal Tory reforms.
4. The Reform Act, 1832; Chartism; later Parliamentary reforms to 1928.
5. The struggle to improve living conditions; labour and social legislation to 1914.
6. Trade Unions: their origins and development to 1914; the General Strike (1926) and after.
7. Progress in education and its effects; newspapers, cheap books and the effects of widespread literacy; changing status of women.
8. The free-trade movement: Peel and Gladstone; Chamberlain and tariff reform; Imperial Preference (Ottawa Agreements).
9. The Irish problem and its effects on British politics; the Home Rule movement and its results.
10. The origins and growth of the Labour Party and its effects.
11. Social and economic conditions and changes after the First World War.
12. Scientific, cultural and religious ideas and developments.

D**UNITED STATES OF AMERICA, 1783-1941**

1. The thirteen states at the end of the War of Independence: government under the Articles of Confederation; the Northwest Ordinance.
2. The American Constitution and its ratification; the Bill of Rights.
3. The Federalist Era, 1789-1801: the financial programme of Hamilton; the rise of political parties; U.S. relations with England, Spain and France; the Virginia and Kentucky Resolutions.

4. The Presidency of Jefferson, 1801-1809; Louisiana Purchase; Burr's Conspiracy.
5. War of 1812: causes; Hartford Convention; Treaty of Ghent; effects of the war in the U.S.
6. The career of John Marshall, 1801-1835: the strengthening of the federal government by his decisions in McCulloch vs Maryland, Ogden vs Gibbons, Marbury vs Madison.
7. The Period of Jacksonian Democracy, 1829-1840: tariffs; Calhoun's Exposition and Protest; rise of the Whig Party; panic of 1837.
8. Settlement of international boundaries: purchase of Florida; the Republic of Texas; the war with Mexico; The Webster-Ashburton treaty; the Oregon Settlement; the Gadsen Purchase.
9. The Civil War: attempts to settle the slavery problem, 1820-1857; sectionalism; the problem of States' Rights; outbreak of the Civil War; foreign affairs during the Civil War.
10. Reconstruction after the Civil War: the position of the Negroes; development of industry; immigration; development of the West.
11. The Growth of Big Business and the Labour Movement: Sherman Anti-Trust Law; the Granger Movement; Knights of Labour and the American Federation of Labour.
12. The Progressive Movement, 1896-1916; political, social and economic reforms under Theodore Roosevelt and Woodrow Wilson.
13. Franklin Roosevelt and the New Deal; reforms; conflict with the Supreme Court; the 'Good Neighbour' policy.
14. Foreign affairs: (i) Monroe Doctrine; France and Mexico; war with Spain; Panama Canal; World War I; League of Nations; events leading to World War II.
 (ii) Relations with China and Japan; purchase of Alaska; acquisition of Hawaii and Philippines; events leading to war in the Pacific.

BIBLICAL KNOWLEDGE

The syllabus is based on the assumption that about three teaching periods, or two hours, per week, over a course of two years, are allocated to the subject.

There is no wish or intention to dictate to schools what version of the Bible should be used in the teaching of Biblical Knowledge, and schools are at liberty to use whichever they prefer. It will not be necessary to indicate which version has been studied when making entry for this subject.

Questions in which the answer depends on a rendering peculiar to one particular version will not be set. Where proper names or direct quotations are used in the questions alternative versions will be printed.

There will be one paper of 2½ hours. It will be divided into three sections and candidates will be required to answer five questions, three chosen from Section B and either two chosen from Section A or two chosen from Section C.

SECTION A. *Old Testament History and Religion.* For 1968, Period III (see below).

SECTION B. *The Life and Teaching of Christ as contained in one of the Synoptic Gospels.* For 1968, St. Luke (see below).

SECTION C. *The Life and Teaching of the Early Church as recorded in the Acts of the Apostles.*

Notes:

In Section A questions will be set each year on one of three periods.

Period I (to be used for 1969) The History and Religion of Israel from Samuel to the Division of the Kingdom, with special reference to I and II Samuel and I Kings 1—12.

Period II (to be used for 1970) The Divided Kingdoms: Prophecy from Elijah to Isaiah, with special reference to I Kings 14—end, II Kings 1—20, Amos, Hosea 1—7, 11, 14, Isaiah 1—7, 28—31.

Period III (to be used for 1968) The Fall of the Kingdom of Judah: Prophecy of the Exilic Age, with special reference to II Kings 21—25, Jeremiah 1—7, 18—24, 26—29, 31—32, 34—44, 52, Ezekiel 1—3, 33—34, 36—37, 47—48, Isaiah 40—45, 49—55.

Period I contains no prophetic texts, but includes a good deal of material concerning the prophecy and other aspects of the religion of the early monarchy; stress will be given to this in the paper.

Periods II and III contain substantial sections of prophecy. Attention should be given to the religious content of the historical material and to the chief features in the teaching of the prophets.

In Section B questions will be set each year on one of the three Synoptic Gospels.

St. Matthew (to be used for 1969)

St. Mark (to be used for 1970)

St. Luke (to be used for 1968)

ECONOMIC AND PUBLIC AFFAIRS

A paper of two and a half hours will be set.

The paper will be divided into two parts. Candidates must attempt each part.

Part I. A series of short questions will be set on both economic and public affairs. Answers must follow the order of the questions. They may be given in note form.

Part II. A choice of essay questions will be set. Candidates must show a knowledge of both economic and public affairs.

In the following syllabus, general principles should be illustrated throughout by examples from Hong Kong. Attention should also be paid to current events which illustrate the topics studied. It is not necessary to memorise lists of statistics.

ECONOMIC AFFAIRS

Some Basic Economic Ideas

The producer and the consumer; primary, secondary and tertiary producers, their interdependence; stages in the flow of goods to the final consumer; the division of labour.

Modern factories, mass production, the shift system.

The different kinds of industry found in Hong Kong.

Population

The census and by-census in Hong Kong, their importance.

Changes of population, birth and death rates, immigration and emigration.

Outline of changes in Hong Kong since 1931.

Sex and age distribution; geographical and occupational distribution.

The Factors of Production

Land: the natural resources of the country, limited and geographically fixed.

Labour: size of population, age distribution, health and working capacity, education and training; wages; mobility of labour.

Capital: capital goods, their accumulation and maintenance.

Management: organisation and technical know-how.

The Location of Industry

Factors which may determine location.

Changes due to modern developments, e.g. in transport.

Government encouragement to industry in Hong Kong.

Imports and Exports

The advantages and difficulties of international trade.

Hong Kong's imports and exports, their nature and flow.

The Marketing of Products

Demand, supply and price; the relation between them; marginal utility.

Elasticity of demand and supply, equilibrium price.

Perfect and imperfect competition.

Ownership in Industry

Private and public enterprise, the sole proprietor, partnership, the limited company, public utilities, Government ownership in Hong Kong.

Stocks and shares, the stock exchange.

Large and small scale industry, advantages and limitations; optimum size for production; the survival of the small firm; specialisation, combination, monopoly.

Money, Banking and Insurance

Different forms of money, the use of credit, inflation and deflation.

Banking facilities, their importance in industry; the Banking Ordinance.

Insurance.

PUBLIC AFFAIRS

Hong Kong as a Colony

The Queen.

Hong Kong and the British Parliament.

The Constitution of Hong Kong

Letters Patent, Royal Instructions.

The Governor and his functions, the Governor-in-Council.

The Executive and Legislative Councils, their membership and functions; standing committees.

How a law is made.

The Urban Council, its membership and functions.

The Administration of Hong Kong

The Colonial Secretary, the Financial Secretary, the Secretary for Chinese Affairs.

The Government Departments and the Civil Service.

The New Territories Administration.

The Heung Yee Kuk, Rural Committees and their duties.

Public Revenue and Expenditure in Hong Kong

Direct and indirect taxes, with examples.

Main objects of public expenditure.

The annual budget.

The Government and the Citizen

The government's responsibility to provide necessary services and to protect the citizen.

The citizen's duty to co-operate, the importance of the individual's work, character and service.

Aid given by voluntary societies.

Water and Food Supply

The provision of adequate and safe water supply.

Markets, licences to sell food, inspection of food preparation.

Government encouragement to agriculture and fishing.

Land and Housing

Government ownership of land; Crown lease; sale by auction and private treaty.

Reclamation of Land.

Overcrowding, its causes and effects.

Squatter areas, dangerous structures.

Resettlement estates.

Low-cost housing: Voluntary, Housing Authority, Government.

Private building: P.W.D. supervision.

Trade and Industry

Trade promotion, integrity in trade and industry, maintenance of standards.

Commercial and industrial organisations.

The Department of Commerce and Industry and its activities.

Labour

Wages, working hours and factory conditions.

The Labour Department and its activities.

Trade Unions and their functions.

Training for management and trade union leadership.

Health

Government, aided and private hospitals and clinics.

Health education in schools and clinics.

The prevention of infectious diseases.

Port Health.

Public Health.

Education

Government, aided and private schools.

Primary, secondary and post-secondary education.

Adult education.

The Education Department and the Board of Education.

Social Welfare

Government aims; relief and rehabilitation.

Co-operation with many voluntary agencies, sponsored locally and overseas.

The relief of the destitute and victims of emergencies.

The care of orphans.

Youth Services, such as Boys' and Girls' Clubs, Scouts and Guides.

Work for cripples and the blind.

Community centres.

Drug addiction: Shek Kwu Chau Rehabilitation Centre.

Juvenile delinquency: contributing factors.

The work of probation officers.

The Press, Radio and Television

Their functions and responsibilities.

Protection against Law Breakers

The police: protection of the citizen, powers of arrest.

The courts: the independence of the judiciary.

Civil and criminal cases.

The Magistrate's Court.

The Supreme Court: trial by jury.

The principles of British justice, the rights of the accused.

Prisons: deterrent and reformatory.

U.N.O. and its Links with Hong Kong

The aims of U.N.O. and the main duties of its members.

The main organs and their chief functions.

Regional commissions, e.g. E.C.A.F.E.

The Declaration of Human Rights.

Commissions on Narcotic Drugs and the Status of Women.

U.N.I.C.E.F. and the Commission on Refugees.

Technical assistance.

The Special Agencies, their general purpose and relation to the life and laws of Hong Kong.

MATHEMATICS

SYLLABUS A

The examination will consist of three papers:

Paper I Arithmetic and Trigonometry (2 hours)

Paper II Algebra ($1\frac{1}{2}$ hours)

Paper III Geometry (2 hours)

Each paper will consist of two sections, A & B. Section A in each paper will contain short questions to be attempted by all candidates, and is aimed at testing accuracy over a wide range of the syllabus. Section B will include a variety of questions and choice will be allowed. The aim of Section B will be to test mathematical understanding and reasoning by means of more difficult problems requiring initiative. Lengthy calculations will, as far as possible, be avoided in Section B questions.

The aim of Papers I & II is to test:

- a. Accuracy of computation. (Check working is expected).
- b. Understanding of the underlying principles which lead to the required answers.
- c. Ability to solve problems rather than to perform mechanical drills in answering stereotyped questions.
- d. Ability to deal with everyday problems of Hong Kong life using local measures of money, length, weight etc.

The aim of Paper III is to test:

- a. Understanding of the underlying principles which lead to the required conclusions.
- b. Knowledge of the fundamental axioms and theorems of geometrical method.
- c. Ability to use theorems in order to build up logical and valid proofs from what is given.
- d. Ability to make clear constructions within reasonable limits of accuracy and to justify them.
- e. Ability in Section B, to lay out a formal proof in an appropriate way.

Although the papers are divided into Arithmetic and Trigonometry, Geometry, and Algebra, any method may be used in any paper, except as otherwise stated. Slide Rules, Flexible and French Curves may be brought into the examination. Four-figure mathematical tables will be provided.

Paper I

ARITHMETIC

Knowledge of Primary School Mathematics is assumed.

Candidates should be familiar with the British, Metric and Chinese systems of weights and measures and with the following monetary systems: pounds, shillings and pence; dollars and cents. Addition, subtraction, multiplication and division applied to numerical calculations. Fractions and decimals. Proportion and proportional parts. Extraction of square roots, by factors and by tables, the long rule not being required. Averages, percentages, simple and compound interest; profit and loss. Elementary mensuration of the triangle, the circle, the rectangular block, the cylinder, the sphere, and the right circular cone. Problems on speeds. Graphs from numerical and statistical data. The use of logarithm tables.

Candidates may be required to give results to a specified degree of approximation, but the use of contracted methods of multiplication and division is not essential.

TRIGONOMETRY

The six trigonometrical ratios, (including their graphs). Solution of right-angled triangles, with simple applications. Easy problems (in two and three dimensions) soluble by analysis into right-angled triangles.

The use of logarithmic and trigonometrical tables.

Radian measure (involving simple numerical examples only); length of arc, area of sector.

Simple relations between ratios (excluding multiple and compound angles).

Angles from 0° to 360° . Easy equations (solutions from 0° to 360° only).

Use of the sine and cosine formulae for a triangle and of the formula $\frac{1}{2}bc \sin A$.

Paper II

ALGEBRA

Elementary algebraic operations; formulae expressing arithmetical generalisation; change of subjects of a formula; factors or expressions of simple types, including trinomials and $a^3 \pm b^3$; easy fractions.

The use of fractional and negative indices. Calculation by logarithms to base 10 with the use of four-figure tables. Solution of linear equations involving not more than two unknowns and quadratic equations involving only one unknown; the solution of simultaneous equations, one linear and one quadratic, involving two unknowns; and simple problems leading to such equations. The use of the remainder theorem; ratio and proportion; variation. Graphs and their simple applications. Arithmetical and finite geometrical progressions.

Paper III

GEOMETRY

The paper in Geometry will contain questions on Practical and on Theoretical Geometry.

Practical Geometry

The questions on Practical Geometry will be set on the constructions contained in Schedule A, together with easy extensions of them. In cases 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.

Schedule A. For Practical Geometry

Bisection of angles and of straight lines.

Construction of perpendiculars to straight lines.

Construction of an angle equal to a given angle.

Construction of angles 60° , 45° and 30° .

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.

Simple cases of the construction of a circle from sufficient data.

Construction of a square equal in area to a given polygon.

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.

Theoretical Geometry

The questions on Theoretical Geometry will consist of problems (i.e. Riders) on the theorems contained in Schedule B. Formal proofs of these theorems will not be asked, but the problems will require a thorough knowledge of the ground to be covered.

Schedule B. For Theoretical Geometry

ANGLES AT A POINT

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

If two straight lines intersect, the vertically opposite angles are equal.

PARALLEL STRAIGHT LINES

When a straight line cuts two other straight lines, and

- (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 the converse.

Straight lines which are parallel to the same straight line are parallel to one another.

TRIANGLES AND RECTILINEAR FIGURES

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

In a polygon of n sides, the sum of the interior angles is equal to $2n - 4$ right angles.

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

If 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.

If 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.

If two sides of a triangle are equal, the angles opposite to these sides are equal; and the converse.

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

If 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.

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

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

The opposite sides and angles of a parallelogram are equal, each diagonal bisects the parallelogram, and the diagonals bisect each other.

If a pair of opposite sides of a quadrilateral are equal and parallel, it is a parallelogram.

The straight line drawn through the middle point of one side of a triangle parallel to another side bisects the third side.

The straight line joining the middle points of two sides of a triangle is parallel to the third side, and equal to one-half of it.

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.

AREAS

Parallelograms on the same base and between the same parallels are equal in area.

Triangles on the same or equal bases and of the same altitude are equal in area.

Equal triangles on the same or equal bases are of the same altitude.

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 angles; and the converse.

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 of the projection on it of the other.

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.

LOCI

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

The 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.

THE CIRCLE

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.

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

Equal chords of a circle are equidistant from the centre; and the converse.

The tangent at any point of a circle and the radius through the point are perpendicular to each other.

The tangents to a circle from an external point are equal.

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

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.

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.

The angle in a semicircle is a right angle; and the converse.

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

In equal circles (or, in the same circle) (i) if two arcs subtend equal angles at the centres, they are equal; (ii) conversely, if two arcs are equal, they subtend equal angles at the centre.

In equal circles (or, in the same circle) (i) if two chords are equal, they cut off equal arcs; (ii) conversely, if two arcs are equal, the chords of the arcs are equal.

If a straight line touch a circle, and from the point of contact a chord be drawn, the angles which this chord makes with the tangent are equal to the angles in the alternate segments.

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.

PROPORTION: SIMILAR TRIANGLES

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

If two triangles are equiangular their corresponding sides are proportional; and the converse.

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.

If a perpendicular is drawn from the right angle of a right-angled triangle to the hypotenuse, the triangles on each side of the perpendicular are similar to the whole triangle and to each other.

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.

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

ADDITIONAL MATHEMATICS

There will be three papers each of two hours. Candidates must take Paper I and either Paper II or Paper III. Each paper will consist of two sections. The first section will contain questions, to be attempted by all candidates, on the more elementary parts of the syllabus. The second section will include a variety of questions, and choice will be allowed.

Slide rules, flexible and French curves may be brought into the examination. Four-figure mathematical tables will be provided.

Paper I—Pure Mathematics I

Simple problems on arrangements, choice and chance.

Simple problems on mathematical induction.

The binomial theorem for a positive integral index, and its use for simple approximations. (Questions on the greatest terms and on sums and properties of the coefficients will not be asked).

Functions of a variable and their graphical representation. Determination of a function from a straight line graph. Meaning of the dy/dx and its determination in simple cases. The forms, graphs, and derivatives of the functions $mx + c$, kx^n . (Proofs will not be required).

Simple problems on differentiation of a sum, product and function of a function.

Applications to small increments, rates of change, speed problems, maxima and minima (questions will be soluble without the use of the second derivative).

The definite integral and its representation as an area; integration as the inverse of differentiation. Integration of simple functions (excluding integration of x^{-1} and excluding integration by parts and by change of variable other than $x = at + b$); application to plane areas and volumes of solids of revolution and to speed-time problems.

Circular measure. Trigonometrical ratios of angles of any magnitude. Graphs of simple trigonometrical functions. The solution of triangles and determination of area (only the sine and cosine formulae and the formulae $\frac{1}{2}bc \sin A$ and $\sqrt{s(s-a)(s-b)(s-c)}$ will be needed; proofs will not be required). Simple trigonometrical problems in three dimensions. Harder questions may also be set on any item in the syllabus for Mathematics Syllabus A.

Paper II—Pure Mathematics II

Indices, logarithms, surds. The remainder theorem.

Arithmetical and Geometrical progressions.

Solution of simultaneous linear equations, involving not more than three unknowns. Simultaneous equations, one linear, in two unknowns.

Elementary properties of quadratic equations and functions.

Graphs and derivatives of simple algebraic and trigonometrical functions (including sums, products, quotients, functions of a function and implicit functions but excluding the inverse trigonometrical functions).

Integration by simple change of variable. (Integration by parts is excluded).

Elementary two-dimensional rectangular Cartesian co-ordinate geometry, e.g. distances, angles, area of a triangle.

The linear equation; perpendicular distance from a point to a line. Easy locus problems. Equation of a circle. Simple curve-tracing. Equation of tangents to a curve.

Formulae for $\sin(A \pm B)$, $\cos(A \pm B)$, $\tan(A \pm B)$. (Proofs will not be required). Applications to multiple angles and simple identities. General solutions of simple trigonometrical equations.

Paper III—Mechanics

Equilibrant and resultant of coplanar forces acting on a particle. The triangle and parallelogram of forces. Simple examples on polygon of forces. Solutions by composition and resolution of forces. Lami's theorem.

Moments of forces, reactions, parallel forces, couples, centre of gravity. Toppling. The equilibrium of a rigid body under the action of coplanar forces.

Pulleys, wheel and differential axle, differential pulley.

Friction. The inclined plane.

Velocity, acceleration, combined and relative velocities, solutions by vectors and calculation. Equations of rectilinear motion with uniform acceleration including graphical solutions. Projectiles on a horizontal plane.

Newton's laws of motion; gravitational and absolute systems of units. Work, energy any power. Conservation of energy. Motion of connected particles. Motion in a circle with uniform speed including centripetal acceleration and centrifugal force. The conical pendulum, simple governor. Rolling. Torque, work done in rotation.

Impulse. Conservation of momentum. Impact between inelastic bodies.

GENERAL SCIENCE AND ADDITIONAL GENERAL SCIENCE

For the General Science (single subject), candidates will take one 2½-hour paper. This paper will be divided into two parts. Part One will consist of short-answer questions which may be set on any items from the General Science Syllabus. All questions are to be answered. Part Two will consist of three sections, each containing 3 essay-type questions as follows:—(i) Physics, (ii) Chemistry, (iii) Biology. Candidates will be required to answer 5 questions, but not more than two from any one section.

N.B. Questions for this paper will be of a simple and straight forward type on the fundamental facts, and basic knowledge of the subject. Some questions may be set to test the candidates' personal experience of practical work.

For Additional General Science (second subject), candidates will take one 2½-hour paper. This paper will be divided into two parts. Part One will contain short-answer questions. Part Two will consist of 3 sections, each containing 3 essay-type questions as follows:—(i) Physics, (ii) Chemistry, (iii) Biology. Candidates will be required to answer all Part One and five questions in Part Two, but not more than two questions from one section.

- N.B. (1) This paper will consist of much harder questions, covering the combined General Science and Additional General Science syllabuses, designed to test the depth of the candidate's understanding of the subject and his experience in practical work.
(2) To pass in the Additional General Science paper, candidates must pass also in the General Science paper in the same or in a previous examination.

The syllabus for candidates taking General Science but not Additional General Science is that part which is not printed in italics.

There will be no practical examination in General Science (single subject), but candidates will not be accepted for this subject unless they have covered a proper course in practical work. Questions may be set to test the candidate's personal experience of practical work and high marks will be given in such questions for evidence of such experience; no marks will be given for a mere statement of theory. Examiners may ask for the science notebooks of any candidate.

The syllabus is not intended to be used as a teaching syllabus. It forms a framework within or round which the teacher's own development of the subject can be fitted. The order of treatment may depend on the equipment in the school and the teacher's own predilections. General Science has

been regarded not as a special science but as one approach to the teaching of science. It is considered as important that, drawing on common experiences of everyday life, the student should be led to some appreciation of scientific principles and the methods by which they have been established. The syllabus inevitably covers a wide range of subject matter. The examiners do not expect that all parts of it will be treated to equal depth, since this might lead to superficial knowledge which is specially to be avoided. Adequate attention should be paid to quantitative treatment where this is specified.

It is considered that General Science taken as a single subject will provide a satisfactory background of scientific knowledge for the citizen, but it does not take the student as far in any section as the separate Physics, Chemistry and Biology subjects. Additional General Science is designed for those who wish to carry their studies beyond the minimum; the course should form a good preparation for sixth form work in science. The complete syllabus thus covers the needs of both future science specialists and those whose main interests lie in other directions.

For convenience of reference the syllabus is divided into separate sections, Physics, Chemistry and Biology, but the interrelations between the various sections should be stressed. Questions set on topics in any one of the sections may involve a knowledge of others. Candidates will be expected to answer questions on the topics set out in the column headed 'Syllabus'. The notes are intended to indicate the scope of the questions which will be set, but they are not to be considered as an exhaustive list of limitations.

GENERAL SCIENCE: PHYSICS SECTION

SYLLABUS

1. Measurement of length and of volume. The use of the measuring cylinder.

2. Measurement of time by use of the simple pendulum.

3. Densities of solids and liquids.

4. Pressure in liquids and gases; transmission of fluid pressure; the hydraulic press.

5. Boyle's law.

6. Mercury and aneroid barometers.

NOTES

Both f.p.s. and c.g.s. systems are expected. Candidates should know the formulae for the volumes of the common regular solids.

The factors influencing the time period of a simple pendulum, but not the formula, should be known.

Experimental determination of densities, e.g. liquids by density bottle and solids by weighing and displacement.

Quantitative questions may be set.

Experimental verification for air is included.

GENERAL SCIENCE (PHYSICS)

SYLLABUS

7. Bicycle pump, force and lift pumps; siphon.

8. Principles of Archimedes.

9. Flotation: the common hydrometer.

10. Simple phenomena of surface tension, capillarity and diffusion.

11. Hooke's law: elastic limit.

12. Simple ideas of force producing movement and acceleration. Inertia.

13. Elementary treatment of friction. The importance of frictional forces on stationary and moving bodies. Methods of reducing friction.

14. Levers: principle of moments. Common balance.

15. Velocity ratio, mechanical advantage and efficiency of machines.

16. Work, energy, power, transformation and conservation of energy applied to the quantitative conversion of energy into its different forms (mechanical, electrical, thermal, etc.).

17. The resolution and composition of inclined velocities and forces.

18. Centre of gravity treated experimentally. Its relation to stability of equilibrium.

19. Centripetal acceleration and force.

NOTES

Simple explanation of syphon in terms of hydrostatic pressures is acceptable.

Application of the principle to the determination of densities of solids and liquids is included.

The treatment should include ships and balloons. Nicholson's hydrometer is not required.

Simple illustrative experiments should be included. Simple explanation in terms of intermolecular forces, and of molecular motion should be given. Quantitative treatment is not expected. Simple demonstrations.

Extension of spring or rubber, treated experimentally. The spring balance.

Examples of bodies moving with constant acceleration, and with constant velocity.

Determination of the coefficient is not required.

Treatment should include equilibrium of a body under the action of parallel forces.

Levers, inclined plane, screw, wheel and axle, hydraulic press and singlestring pulley systems (e.g. block and tackle, Weston's differential pulley) are included.

Horse-power is included.

Resolution in two directions, at right angles only, is expected.

Stable, unstable and neutral equilibrium.

Non-mathematical treatment only.

GENERAL SCIENCE (PHYSICS)

SYLLABUS

20. Mercury and alcohol thermometers. Centigrade and Fahrenheit types.

21. Thermal expansion of solids, liquids and gases. Effects and applications of expansion.

22. Coefficient of linear expansion.

23. Maximum density of water.

24. Relation between volume and temperature of a gas at constant pressure, and between pressure and temperature at constant volume.

25. Absolute temperature: the gas equation $(pv/T) = \text{constant}$.

26. Quantity of heat; calorie, B. Th.U.; therm; specific heat.

27. Determination of specific heats using thin calorimeters.

28. Calorific values of fuels and foodstuffs.

29. Change of state: evaporation and boiling. Latent heat of fusion and of vaporization and their evaluation for water (a) by simple methods, (b) by more accurate methods.

30. Boiling and melting points, and the influence of pressure and of dissolved substances on them.

31. Humidity of air: dewpoint.

32. Heat as a form of energy.

NOTES

Maximum and minimum thermometers, including the clinical thermometer, and the determination of fixed points, should be described.

Coefficients are excluded, but the effects and applications of expansion, e.g. expansion of railway tracks, pendulums, thermostats, riveting, should be discussed.

Questions on experimental determination and simple calculations may be set.

Application of freezing to ponds, etc.

Simple experimental methods only.

A knowledge of the pressure coefficient at constant volume is not required. Calculations reducing the volume of a gas to S.T.P. may be set.

Determination of specific heat of a solid, and of a liquid by a simple method, e.g. using a heavy vessel.

The method of cooling is not required.

The work should include cooling by evaporation.

Cooling curves as applied to the determination of melting points should be included.

Wet bulb and dry bulb thermometers. Reference should be made to such topics as dew, mist, hoar frost, 'sweating' of walls.

Simple treatment only is required.

GENERAL SCIENCE (PHYSICS)

SYLLABUS

33. Conversion of heat into work.
34. *Mechanical equivalent of heat.*
35. Transfer of energy by conduction, convection and radiation.
36. Effect of nature of a surface on the energy radiated and absorbed by it.
37. Rectilinear propagation of light. Shadows; eclipses.
38. Reflexion of light: laws of reflexion.
39. Formation of images by plane mirrors.
40. Refraction at a plane surface.
41. *Snell's law. Determination of refractive index.*
42. Total internal reflexion. Critical angle. *Calculation on critical angle.*
43. Converging and diverging lenses. Real and virtual images.
44. Focal length of a converging lens: linear magnification. *Experimental determination of focal length of a converging lens.*
45. Character of the image produced by lenses determined by graphical methods.
46. The physics of the human eye.

NOTES

- The principle of steam and internal combustion engines should be discussed.
- Determination by a simple method.*
- The phenomena should be illustrated by simple experiments. Related topics should include: the conductivities of common materials in relation to their uses, e.g. cotton and woollen clothing; the Davy lamp; heat insulation; hot water system; motor-car cooling system; ventilation, land and sea breezes; thermos flask.
- The pin-hole camera should be included.
- Case of two plane mirrors at 90° is included.
- Examples such as apparent reduction in depth of pond.
- Simple quantitative examples.*
- Totally reflecting prisms as used in prism binoculars, and examples such as mirage and fish-eye view should be given.
- Include the magnifying glass and the camera; and the projection of large real images by a single converging lens, as in the projection lantern.
- Functions of the cornea, aqueous and vitreous humours, iris, lens and retina.

GENERAL SCIENCE (PHYSICS)

SYLLABUS

47. Accommodation: long sight and short sight and their correction by spectacles.
 48. *The astronomical refracting telescope and the compound microscope.*
 49. Dispersion of white light by a prism: the spectrum.
 50. Colour.
 51. *Extension of the visible spectrum to the ultraviolet and infra-red.*
 52. Production of sound by vibrating systems; its transmission in a material medium.
 53. Determination of the velocity of sound.
 54. Reflexion of sound.
 55. Frequency and its relation to pitch.
 56. Vibration of a stretched string.
 57. Frequency of the note emitted by air column in a pipe closed at one end.
 58. Resonance.
 59. *Quality of a musical note. Application of the fundamental principles of sound to instruments of the orchestra.*
 60. Simple phenomena of magnetism.
- Qualitative corrections only.
- Very elementary treatment: ray diagrams are not required.*
- Recombination of the spectrum colours to form white light is included.
- The additive and the subtractive combination of coloured lights and of pigments should be given.
- Simple properties and method of detection of these radiations.*
- Descriptions of vibrating sources, e.g. tuning forks and of experiments to demonstrate the necessity for a material medium are expected.
- A simple method only is required.
- Including echoes.
- e.g. experiments with a siren or a toothed wheel.
- Qualitative treatment of the factors influencing the pitch of the note emitted.
- To be treated qualitatively.
- Mechanical and acoustical examples should be included.
- Simple treatment of overtones produced by vibrating strings and air columns.*
- Including the properties of magnets: magnetic induction, magnetic screening, distinction between magnets and unmagnetized magnetic materials, methods of magnetization and demagnetization, magnetic fields and lines of force, including a qualitative treatment of neutral points. Questions involving a knowledge of molecular theories of magnetism will not be set.

GENERAL SCIENCE (PHYSICS)

SYLLABUS

NOTES

61. Magnetic properties of iron and steel.
62. The magnetic field of the earth. The magnetic compass.
63. Simple voltaic cell, Leclanché cell (wet and dry).
64. Accumulators.
65. Current; the coulomb, the ampere.
66. Potential difference and electromotive force: the volt.
67. Electrical energy; power. The watt, kilowatt and kilowatt-hour.
68. Magnetic effect of a current.
69. Behaviour of a coil carrying a current in a magnetic field, the D.C. motor.
70. Galvanometers, voltmeters and ammeters.
71. Ohm's law: resistance: the ohm: *resistivity*.
72. Resistances in series and in parallel.
73. The heating effect of a current.
74. The wiring of buildings: the use of switches and fuses: *two-way switches*.
75. Chemical effect of a current. Electrolytes and non-electrolytes: *Faraday's laws of electrolysis*.
- Simple experiments illustrating the use of these materials. A knowledge of hysteresis is not required.
- A qualitative treatment of declination (variation) and *dip (inclination)*.
- Including polarization, local action. Importance of internal resistance.
- Either lead or iron type acceptable. Simple theory only, without chemical equations, is required. Care and maintenance, including practical details of charging and discharging should be described.
- The definitions of the units, coulomb and ampere, are not required.
- The definition of the volt is not required.
- Calculations on power of circuits and on cost of maintaining a circuit are included.
- Magnetic field associated with a current carrying conductor, e.g. straight wire, circular coil, solenoid. Electro-magnets: electric bell.
- Simple moving iron and moving coil instruments should be considered.
- Calculations on Ohm's law applied to whole circuits and to single resistors may be set.
- Calculations may be set.
- Applications, such as electric fires, irons, fuses and filament lamps should be included. Numerical examples will not be set.
- Safety precautions, e.g. earthing should be explained.
- Electrolysis of dilute sulphuric acid and of copper sulphate solution, using copper electrodes, and electroplating should be included.

GENERAL SCIENCE (PHYSICS)

SYLLABUS

NOTES

76. Experiments to illustrate the phenomena of electromagnetic induction. Simple A.C. generator, A.C. transformer, induction coil.
77. Simple experiments to show magnetic heating and chemical effects of alternating currents. The grid system of transmission of energy.

78. Telephone transmitter and receiver, and their connexions in a simple circuit.
- Experiments to illustrate the difference between A.C. and D.C.*
- A carbon microphone and a moving diaphragm receiver are expected.*

GENERAL SCIENCE: CHEMISTRY SECTION

Wherever possible, questions will be set to test the candidates' experience of the more important experimental work of the syllabus.

When commercial processes are asked for no technical details of industrial plant are expected.

SYLLABUS

NOTES

1. The air and its chief gaseous constituents; increase in weight during the oxidation of metals.
2. Proportion of oxygen in air. Laboratory preparation of oxygen; its commercial preparation from liquid air. Properties and uses of oxygen; acidic and basic oxides. Nitrogen as a diluent in the air.
3. Water: natural waters, sea-water—its economic importance. Water, an oxide of hydrogen. The liberation of hydrogen from water by sodium, calcium and iron.
4. Preparation of hydrogen from steam and from dilute acids. *The reaction between steam and heated iron as a reversible reaction*. The properties and uses of hydrogen. Oxidation in terms of addition of oxygen or removal of hydrogen; reduction as removal of oxygen or addition of hydrogen.
5. Diffusion of hydrogen and other gases; simple ideas of molecular motion.
6. Hydrogen peroxide; preparation, properties and uses.
- A detailed knowledge of the rare gases is not expected.
- The proportion of oxygen should be shown by burning phosphorus, or by using alkaline pyrogallol. Simple ideas on fractional distillation should be included.
- A qualitative treatment only is expected.

GENERAL SCIENCE (CHEMISTRY)

SYLLABUS

7. Water as a solvent for gases and solids. Evaporation, distillation, fractional distillation, crystallization, filtration, precipitation and the use of these processes in preparing pure substances. Efflorescence and deliquescence.

8. Solvents for fats and oils; paints and lacquers.

9. Difference between colloidal and true solutions simply illustrated by Tyndall effect and dialysis, and milk as a colloidal dispersion of fat.

10. Saturated and unsaturated solutions; determination of solubility; solubility curves and simple deductions from them.

11. Atmospheric gases dissolved in water; their biological significance.

12. Hard and soft water; temporary and permanent hardness; methods of softening water.

13. Preparation, properties and uses of carbon dioxide. Washing soda. The ways in which carbon dioxide is constantly added to and removed from the air. The carbon cycle.

14. Quicklime, slaked lime, calcium carbonate—limestone and chalk, calcium bicarbonate. *The ammonia-soda (Solvay) process.* The precipitation of metallic carbonates.

15. Combustion of carbon-containing substances in (a) plentiful, (b) limited supplies of air. The Bunsen burner and its flames. *Slow and rapid combustion.* Combustion of a candle as typical of hydrocarbons.

16. Coal. Coal gas, coke, coal tar and ammonia as products of the destructive distillation of coal. Coal fires. Energy changes in combustion; the energy relationship in the processes of photosynthesis and respiration. *Water gas and producer gas from coke.* *The isolation of hydrogen from water gas.*

NOTES

Reference should be made to the products obtained from petroleum. No reference to vapour pressure is expected.

Mention should be made of the use of solvents for cleaning. No chemistry of fats and oils is expected. The emphasis is on solvents other than water.

Simple ideas of particle size. Reference should be made to everyday examples of colloids.

The examiners will take account of the fact that, in some areas, hard water does not occur naturally.

The action of carbon dioxide on sodium hydroxide should be included. Mention should be made of the uses of carbon dioxide in fire extinguishers, fruit preservation, effervescent drinks, aerated waters and refrigeration.

Respiration should be treated as an example of slow combustion.

GENERAL SCIENCE (CHEMISTRY)

NOTES

17. Different forms of carbon. Properties and uses of graphite and charcoal.

18. Carbon monoxide; its preparation from carbon dioxide and its properties. Carbon and carbon monoxide as reducing agents.

19. *Simple organic compounds.* Preparation of ethyl alcohol from sugar and its oxidation to acetic acid. Preparation of ethyl acetate. Carbohydrates (cellulose, sucrose, glucose and starch) as examples of the peculiar ability of carbon to form compounds with many carbon atoms. Conversion of starch to glucose and of protein to amino-acids. Fats as glycerol esters. Manufacture of soap.

20. Sodium chloride. Preparation of hydrochloric acid, properties. Chlorine; its production by electrolysis and by oxidation of hydrochloric acid. Bleaching powder and sodium hypochlorite solution and their uses.

21. Sodium and potassium nitrates. Preparation and properties of nitric acid. Nitrates. Laboratory preparation of ammonia and its synthesis from nitrogen and hydrogen. Ammonium salts, their importance and uses; the oxidation of ammonia into nitric oxide and nitric acid. *Preparation of pure nitrogen from any one compound.* Comparison of this gas with atmospheric nitrogen. The inert gases. The nitrogen cycle. Nitric oxide and nitrogen peroxide as reduction products of, and in relation to, nitric acid. Nitrous oxide and its use in anaesthesia.

22. Sulphur: its extraction and uses: Oxidation to sulphur dioxide. Preparation of sulphur dioxide from a sulphite. Properties and uses of sulphur dioxide. Manufacture of sulphuric acid from sulphur dioxide (contact process). Its properties as acid and dehydrating agent. *Hydrogen sulphide: preparation and properties, including precipitation of metallic sulphides.*

23. Sand and silica. Water glass. Glass.

24. Elements, compounds and mixture; chemical change and physical change. Law of conservation of mass and the constancy of chemical composition (definite proportions).

This work should be correlated with Biology, Section I (e). The hydrolysis of proteins can be treated as analogous to that of starch.

Compare with the oxidation of ammonia in the soil.

GENERAL SCIENCE (CHEMISTRY)

SYLLABUS

25. Atoms, molecules, use of symbols, formulae and chemical equations in so far as they assist in giving a mental picture of a chemical action.

26. Simple calculations from equations of reacting weights of substances.

27. Equivalent weights of elements and their determination by the displacement of hydrogen and by the addition or removal of oxygen.

28. Simple study of atomic theory; Dalton, Gay-Lussac, Avogadro.

29. Types of chemical change, including reversible reactions. Catalysts and their importance.

30. Equivalents of acids, and bases; simple volumetric analysis involving the use of normal solutions.

31. Characteristics of acids, bases and salts. General properties of acids. Preparation of caustic soda—a typical base.

32. Methods of preparing salts.

33. The phenomena of electrolysis of solutions such as cupric chloride, brine and of acidified water. Electrolytes and non-electrolytes. Simple explanation of electrolysis in terms of ions. The use of electrolysis in the extraction of copper. Extraction of magnesium and aluminium. Copperplating. The production of caustic soda from brine.

34. Chief properties and uses of aluminium, zinc, copper, iron and lead. The rusting of iron and its prevention. Alloys: constituents and uses of steel, brass, type-metal, duralumin and soft solder. The thermit process. Action of water on potassium, magnesium, zinc and copper. Displacement of one metal by another. Activity series.

NOTES

Equations in either words or symbols will be accepted.

Equations in symbols will be expected.

It is expected that the action of a few simple catalysts will be dealt with, and by reference to such instances as enzymes, their importance referred to.

Reference should be made to baking powders and acids in everyday use, e.g. citric, tartaric and acetic but candidates are not expected to deal with the chemistry of these acids. Refer to soap as an example of a salt.

Candidates should be familiar with the experimental details of the following methods: (i) neutralization and crystallization, (ii) action of acid on metal, (iii) action of acid on insoluble base or carbonate, (iv) precipitation.

Rough proportions, rather than precise percentage compositions of alloys should be noted.

GENERAL SCIENCE: BIOLOGY SECTION

Although the special animal and plant studies required are set out in separate sections of the syllabus it is assumed that they will be integrated by frequent cross-reference and comparison in the teaching. The interdependence and unity of life should be stressed throughout. The differences should be noted between living and non-living matter, and between plants and animals.

Not only is a knowledge of the structure and physiology of animals and plants in the schedule required, but consideration of their natural history and ecology is also essential and evidence of this approach will be expected in the written answers. Personal observations on living organisms should be made wherever possible, and great importance attached to experimental work. When the cellular structure of particular animal or plant organs is being considered this should, wherever possible, be demonstrated by means of the microscope or a microprojector. For most purposes a hand lens is sufficient; a detailed knowledge of cell structure will not be required except where specifically indicated in the syllabus.

No questions will be set on evolution, but the idea of evolution should be introduced and illustrated at relevant points in the course. It is hoped that teachers will at least outline the evidences of evolution from the occurrence of fossils and from simple morphology. In the same way, the general discussion of reproduction should include brief reference to the facts of heredity, although no questions will be set on the laws of inheritance.

SYLLABUS

1. The general elementary structure and physiology of a mammal.

(a) The main structural features of a mammal including the general arrangement of the internal organs.

(b) The general plan of the skeleton and its functions. One type of joint as illustrated by the knee or the elbow, and the way the muscles act on the bones to cause movement.

(c) The structure of a tooth and its insertion in the jaw-bone. Incisors, canines, premolars and molars. The relation of dentition to diet as illustrated by man, a herbivore and a carnivore.

NOTES

It is suggested that a small mammal, e.g. rabbit, rat, or guinea-pig be used for most of the work, but it is important that there should be frequent reference to man.

Candidates should be made familiar with the appearance and position of the internal organs referred to in the syllabus through actual dissections shown them by the teacher. They will not be expected to reproduce from memory drawings of complete dissections they have seen.

The names of the main bones of the skeleton only are required. Names of vertebrae and of the individual bones of the skull and pelvis are not required.

GENERAL SCIENCE (BIOLOGY)

SYLLABUS

NOTES

(d) Alimentary canal. Food substances and diet. Digestion, including the functions of the liver and pancreas. The absorption, transport and utilization of digested food. The function of the liver in the general body metabolism.

Applications of the fundamental principles of nutrition to the keeping of either poultry or rabbits or goats or pigs or other farm animals. Methods used to ensure the rearing of healthy animals.

(e) The main features of the circulatory system. The structure of the heart. Structure and functions of the blood. Capillary circulation.

(f) Respiration: the respiratory organs and the mechanism of breathing. Tissue respiration. The role of oxygen in the liberation of energy for the activities of the living body.

(g) Excretion by kidneys, sweat glands and lungs. Elementary treatment of the structure of the kidney and of filtration and reabsorption.

(h) Structure and functions of the skin.

(i) Regulation of body temperature and the importance of the maintenance of a constant body temperature.

Tests for reducing sugar, starch, protein (one test only) and fats should be carried out by candidates. The importance of vitamins and enzymes should be stressed. Names of specific enzymes will only be required in the case of ptyalin, rennin and pepsin, but candidates should understand that there are specific enzymes in the small intestine acting on proteins, carbohydrates and fats. The action of ptyalin, rennin, and pepsin should be studied experimentally.

Emphasis should be given to food requirements, including suitable maintenance and production rations.

Names will be required only of the main blood-vessels of the liver and kidney and those entering and leaving the heart. Blood should be examined microscopically. To demonstrate capillary circulation a tadpole's gill or tail can be used, or a frog can be conveniently anaesthetized (for at least an hour) by immersion for 20 min. in a 1% solution of urethane; the capillaries can be seen in the web between the toes.

See also Chemistry Section 15.

The kidney should be treated as comprising cortex and medulla and consisting of a branched system of tubules, well supplied with blood-vessels, leading to the ureter. Details of the courses of the tubules and their blood-vessels will not be required.

A vertical section of the skin should be examined with the aid of a microscope or microprojector.

GENERAL SCIENCE (BIOLOGY)

SYLLABUS

NOTES

(j) A simplified account of the brain and spinal cord. Reflex action and how it differs from voluntary action. The principal sense organs, their position and function. The structure of the eye and ear simply treated. The use of spectacles for the correction of short and long sight.

(k) *The co-ordination of the body functions by means of hormones, e.g. thyroxin, adrenalin and insulin.*

(l) The reproductive organs and a general outline of the development, nutrition, respiration, and birth of the embryo.

2. External features, habits, movements, and life history of a fish (including gills), a frog, a bird, and a small mammal.

3. INSECTS. Outlines of the life history, the mode of life and the economic importance of; butterfly (or moth), (or mosquito), house-fly, honey-bee or ant.

4. FLOWERING PLANTS.

(a) Outlines of the external morphology of a simple herbaceous plant.

(b) Characteristic features of two of the following trees in summer and in winter: flamboyante, bauhinia, acacia, cassia glauca, bombax, South China pine, camphor wood.

(c) Stem, root, and leaf to be treated with reference to their functions and to experiments in plant physiology. (See Section 5 below).

The internal structure of stems and roots to show the arrangement of tissues.

Only the external structure of the brain is required, but reference should be made to the distribution of white and grey matter. The ear should be treated as consisting of a cochlea sensitive to vibrations and semicircular canals sensitive to position; questions involving detailed structure of the membranous labyrinth will not be set.

Names of other hormones will not be expected.

Details of the cell divisions and the anatomy of the embryo are not required.

Candidates will be expected to study living examples, and to make records from their own observations. They should consider how the animals are adapted to their environment and type of life. No more detail is expected than can be seen with the aid of a hand lens.

Candidates should make their own observations on the insects in their natural surroundings, and these should be supplemented by records made from living specimens kept in the laboratory.

A hand lens only is needed for the study of roots and stems, but the internal structure of a leaf should be studied by means of a microscope or a microprojector. Details of secondary thickening in a stem are not required.

The development of the various tissues present is not required, only their mature structure.

GENERAL SCIENCE (BIOLOGY)

SYLLABUS

NOTES

(d) The parts of a flower and their functions. The pollination of one insect-pollinated flower and of one wind-pollinated flower.

Fertilization and the development of fruits.

(e) Fruit and seed dispersal.

(f) The structure and germination of a seed.

(g) The general characteristics of annuals, biennials and perennials illustrated by plants commonly grown in gardens or on farms.

(h) A study of the development and methods of cultivation of one of the following crop plants: potato, maize, bean, pea, rice, sugar cane, ground nut, banana.

(i) Weeds.

(j) Types of storage organs illustrated by three examples. Types of natural vegetative reproduction illustrated by three examples. Grafting and budding.

5. PLANT PHYSIOLOGY.

(a) The process of diffusion and osmosis. The absorption of water and mineral salts. The importance of turgor. Water or sand cultures.

(b) The rise of water up the xylem vessels.

Fertilization should be treated without reference to microscopic detail other than the growth of the pollen tube and fusion of nuclei. It should be studied where possible in the same flower as a sequence of pollination.

Candidates should be familiar with common methods of dispersal illustrated by a single example of each.

It is advantageous to follow up pollination and fertilization by studying the seed of the same plant, where this is practicable.

One example of an annual and one of a perennial should be considered. In each case its success and the methods employed to control it should be explained.

Only one method of grafting is required.

The whole of this section should be treated experimentally with sufficient theory to explain the phenomena and their importance to the plant.

These processes should be shown with an artificial cell and with living material.

The path should be demonstrated by the use of dyes. Questions will not be set on causative forces.

GENERAL SCIENCE (BIOLOGY)

SYLLABUS

NOTES

(c) The process of transpiration.

(d) Photosynthesis: the nature of the process itself, and the use of the manufactured food. The great importance of photosynthesis to life in general.

(e) Respiration: the nature of the process and its significance in other vital activities. The carbon, energy and food cycles.

(f) Growth and its relations to external stimuli.

(g) Conditions for seed germination, and further conditions for subsequent healthy growth of seedlings into mature plants.

(h) Soils, their constituents, and their characteristics.

(i) The nitrogen cycle, including the living organisms, which play a part in it.

Manuring and the rotation of crops.
Soil improvement.

(j) The relation between the soil and the plants and animals living in it.

Experimental work should include the loss in weight of a potted plant or of a leafy shoot in a test-tube, the use of cobalt chloride paper, and the effect of external conditions on the rate of water loss. When a potometer is used, its limitations should be stressed.

The candidates should be able to show by experiments the necessity for light, carbon dioxide and chlorophyll; the formation of starch and the output of oxygen.

Experiments should be carried out on gaseous exchange, and on heat production. Links should be made here with the animal kingdom, showing the interdependence of animals and plants.

Food chains: at least one should be chosen from the local environment.

This should include the regions of growth in root and shoot, geotropic response of primary roots and shoots, phototropism of shoots and hydrotropism of roots.

Candidates will be expected to have carried out simple experiments on the physical properties of soil. They should know how to determine the amount of air, water and humus (by ignition), and how to compare capillarity and porosity of different samples of soil.

Names of individual bacteria are not required.

This should be simply treated.

This section should be related as far as possible to local conditions, including reference to agricultural methods associated with local soils.

GENERAL SCIENCE (BIOLOGY)

SYLLABUS

6. Microscopic Plants and Animals.
The cell as a unit of life. The different degrees of complexity in living things as illustrated by a simple study of Amoeba, Spirogyra and Hydra.

7. Bacteria and fungi (including a yeast, a mould and a parasitic fungus) as agents of change, decay, and disease: sterilization and its application to the preservation of food: beneficial effects of decay.

NOTES

For this section the use of a microscope or microprojector is essential.

PHYSICS

One paper of 2½ hours

GENERAL PHYSICS

SYLLABUS

1. Fundamental Units: mass, length, time.

2. Measurement of length, area, volume.

3. Time and its measurement.
The simple pendulum.

4. Mass and weight. The spring balance. The beam balance. Hooke's Law.

5. Force.

6. Density and its determination.

7. Principle of Archimedes. Flotation.

8. Rectilinear motion, Inertia, Momentum.

9. Moment of a force.

10. Centre of gravity. Parallel forces.

NOTES

The ultimate standard units of these in both Metric and British systems. The year. Sidereal and solar days.

Use of measuring instruments: e.g. vernier, screw gauge, calipers.

Experiments with a simple pendulum, relation of period to length, independence of mass of bob and of amplitude (for small oscillations). Pendulum clocks. The pendulum formula should await some explanation of force and the acceleration due to gravity. Measurement of "g" with a simple pendulum.

Use of these balances to compare masses and weights. The distinction between mass and weight need not be greatly emphasised at this stage. It should be clearly indicated when force, inertia and motion are treated. Elastic limit and yield point are worth mentioning.

Introduction to force. Common forces: pushes and pulls, gravity, tensile force, force of friction, pressure. Effects of a force: change of shape, change of size, motion.

Absolute and relative densities. Density of a solid, density of a liquid: experimental determination by simple methods. Density of a gas, density of air could profitably be demonstrated.

Experimental verification and applications. Ships, airships, balloons. Hydrometers. Compound bodies in fluids, e.g. wood & lead.

Speed, velocity, acceleration. Equations of uniformly accelerated motion. Motion under gravity. Problems on bodies falling freely. Newton's laws of motion. Units of force. Conservation of momentum. Rate of change of momentum. Simple problems. Reaction.

Turning effect or torque. Principle of Moments.

Experimental treatment: C.G. of a lamina. Relation to stability of bodies. Composition of parallel forces.

GENERAL PHYSICS

SYLLABUS

11. Vector quantities.

NOTES

Addition and subtraction of vectors. Composition and resolution of vectors. Experimental treatment and simple problems. Conditions of equilibrium of co-planar non-parallel forces.

12. Work, Energy, Power.

Work done by a force. Metric & British units of work. The transformation of energy. Quantitative conversion of energy into its different forms (mechanical, electrical, thermal) Horsepower. The watt. Kinetic and potential energy. Conservation of energy.

13. Machines and the Principle of Work.

Levers, Single-string pulley systems (excluding the differential pulley), Wheel and Axle, Inclined Plane, Screw. Mechanical Advantage (or Force Ratio), Velocity Ratio, Efficiency. Change in efficiency with load.

14. Friction.

Simple experiment on friction, including determination of static and kinetic coefficients. Empirical laws of friction: conditions under which these hold. Normal reaction.

15. Pressure in gases. Barometers. Pumps.

Boyle's Law: experimental verification and simple problems.
Aneroid and mercury barometers, including the Fortin barometer.
Bicycle pump, lift pump, force pump, simple mechanical vacuum pump.

16. Pressure in liquids.

Pressure = Depth \times Density.
Transmission of fluid pressure. Pascal's Law. The hydraulic press.

HEAT LIGHT AND SOUND

SYLLABUS

17. Mercury and alcohol thermometers. Centigrade and Fahrenheit scale.

18. Thermal expansion of solids, liquids and gases.

19. Coefficient of linear expansion. Coefficient of apparent expansion of liquids.

20. Maximum density of water.

NOTES

Maximum and minimum thermometers including clinical thermometer; the graduation of a mercury thermometer is included.

Effects e.g. expansion of railway tracks, clock pendulums and balance wheels, and their compensation. Applications e.g. thermostats, riveting etc.

Experiments on their determination and simple calculations are required.

Application to freezing of ponds etc.

HEAT LIGHT AND SOUND

SYLLABUS

21. Pressure—volume—temperature relationship for gases, the gas equation, absolute temperature.

22. Quantity of Heat; the calorie, B. Th.U., therm; specific heat, water equivalent.

23. Change of state; evaporation and boiling, latent heats of fusion and vaporisation.

24. Boiling and melting points and the influence of pressure and of dissolved substances on them.

25. A qualitative treatment of hygrometry, humidity, dew point.

26. Relation between thermal and mechanical energy.

27. Transfer of heat energy by conduction, convection and radiation.

28. Rectilinear propagation of light, shadows, eclipses.

29. Reflection of light. Laws of reflection. Plane and spherical mirrors.

30. Refraction of light at a plane surface, angle of incidence and of refraction, refractive index. Snell's Law. Real and apparent depths.

31. Total internal reflection, critical angle.

32. Converging and diverging lenses.

NOTES

R, the universal gas constant, is not required. Experimental verifications and the use of a constant volume gas thermometer based on two fixed points are expected.

Determination of specific heats of solids and liquids. The method of mixtures is required, but not the method of cooling. Meaning of calorific values of fuels and foodstuffs.

Determination of latent heats of fusion and vaporisation for water.

Qualitative only, although the determination of melting point by cooling curves should be done.

Dew, mist, fog, cloud, 'sweating of walls' should be covered. Wet and dry bulb thermometer.

Demonstration only of mechanical equivalent of heat. Simple calculations on "J" are included.

Qualitative only. The phenomena should be illustrated by simple experiment and applications; e.g. clothing, the Davy safety lamp, heat insulation, ventilation, land and sea breezes, the thermos flask.

The pin-hole camera should be included.

The formation of images by plane and spherical mirrors, including graphical construction and use of formulae. Determination of focal length of spherical mirrors.

The determination of refractive index by tracing rays through a parallel-sided block, a prism, and by real and apparent depths should be included. Minimum deviation in a prism is not required.

Use of reflecting prisms in binoculars, and other illustrations.

Formation of images, graphical construction and use of formulae for lenses are required. The formula relating focal length to radii of curvature of lens faces is not required. Determination of focal length of lenses. Combinations of lenses and of curved mirrors are excluded.

HEAT LIGHT AND SOUND

SYLLABUS

33. Magnifying glass, camera, projection lantern.

34. The physics of the human eye, accommodation, long and short sight, correction by spectacles.

35. The compound microscope and the astronomical telescope.

36. Dispersion of light by a prism. The pure spectrum.

37. Mixture of coloured lights. Colours by absorption.

38. Simple ideas of photometry. Inverse square law. Shadow photometer, grease-spot photometer.

39. Production of sound by vibrating systems; its transmission in a material medium.

40. Determination of the velocity of sound by a simple method.

41. Reflection of sound.

42. Frequency and its relation to pitch. Wave-length.

43. Frequency of note emitted by a stretched string in relation to length, tension, and mass per unit length of the string.

44. Frequency of the note emitted by an air column closed at one end in relation to its length.

45. Resonance.

46. Quality of a musical note.

NOTES

Calculations of spectacle lenses are not required.

Single objective and single eye lenses only need be considered.

Minimum deviation calculations are not included.

Standard candle. Intensity of illumination measured in foot-candles. Normal incidence only.

Description of vibrating sources e.g. tuning fork. Experiments to demonstrate the necessity for a material medium.

Methods in free air or using resonance tube. The effect of temperature and of wind on the velocity of sound.

Echoes.

Experiments with a siren or a toothed wheel.

A treatment for a string sounding its fundamental note only is required.

Mechanical and acoustical examples should be included. Resonance tube, first and second positions of resonance and end correction are included.

Simple treatment of overtones produced by vibrating strings and air columns.

ELECTRICITY AND MAGNETISM

SYLLABUS

47. Simple phenomena of magnetism.

48. Magnetic properties of iron and steel.

49. The magnetic field of the earth.

50. Simple phenomena of electrostatics; conductors and insulators; charging by induction.

51. Primary cells and their defects.

52. Accumulators, lead and iron type.

53. The chemical effect of electric current. Electrolytes and non-electrolytes. Faraday's Laws. Electrochemical equivalent and the measurement of current electrolytically. The coulomb; the ampere.

54. Potential difference; electromotive force. The heating effect of current. The volt, the watt and the kilowatt-hour. Joule's Law.

55. The magnetic effect of current.

56. The behaviour of a flat coil carrying a current in a magnetic field.

The moving coil galvanometer.

The D.C. motor.

NOTES

The properties of magnets; magnetic fields and lines of force, including a qualitative treatment of neutral points. Magnetic induction; magnetic screening. Methods of magnetising and demagnetising: Simple Molecular Theory.

Simple experiments illustrating the differences between these materials when used as electromagnets and permanent magnets. The care of magnets; keepers.

A qualitative treatment of declination and dip.

The gold-leaf electroscope; the electrophorus. The distribution of charge on a conductor and the action of points. The Van de Graaff generator.

Simple voltaic, Leclanché (wet and dry) and Daniell cells. Polarization, local action, and back e.m.f. due to polarization.

Simple theory only—chemical equations will not be required. The care and maintenance, including charging and discharging, should be covered. Capacity of a cell in ampere-hours. Simple calculations.

Elementary phenomena of electrolysis including the electrolysis of acidulated water and of copper sulphate solution. Electro-plating.

Relationships between the coulomb, the joule and the volt, the ampere and the watt are expected. Calculations on heating effect and the cost of electrical energy may be set.

A qualitative treatment of the magnetic field associated with a current-carrying conductor, e.g. straight wire, flat circular coil, solenoid. Uses of electromagnets; e.g. the electric bell; the moving iron meter.

The use of suspended coil instruments with lamp and scale is not included.

ELECTRICITY AND MAGNETISM

SYLLABUS

57. Ohm's Law; resistance; the ohm. Resistivity.

58. Ammeters, voltmeters. Ammeter shunts.

59. Comparison of resistances by the meter bridge; comparison of e.m.f.s by the potentiometer.

60. Electromagnetic Induction.

NOTES

Experimental verification of Ohm's Law is not expected. The law should be applied both to single resistors and to whole circuits. Calculations involving series and parallel arrangements of cells and resistances may be set.

Problems on the conversion of a galvanometer to an ammeter or voltmeter for a stated full-scale deflection.

The measurement of the internal resistance of cells is not required.

Descriptive theory only, illustrated by common examples. The simple D.C. generator (simple A.C. generator modified with commutator), the induction coil, telephone receiver, moving coil loudspeaker, etc.

Four-figure mathematical tables will be provided for this examination.

CHEMISTRY

One 2½-hour paper will be set.

SYLLABUS

NOTES

1. The states of matter and their interconversion. Laboratory techniques, including the collection and handling of gases. The use of the bunsen and balance. Simple determinations of melting points and boiling points. Distillation, fractional distillation and crystallisation as methods of purification. The use of physical constants as a means of identifying substances and of testing their purity. The use of the separating funnel.

Solution, filtration, washing, evaporation, sublimation, drying etc.

Physical change. (1) (2).

2. The air and oxygen and the nature of burning. The heating and/or burning of elements in the air. (3)

Air is necessary for burning, a portion of it is used up, a new substance is formed and there is a gain in weight. Air has mass and possibly the air used up is responsible for the gain in weight. A first introduction to the conservation of mass and to a chemical change (a substance with a fresh set of properties is formed).

The portion of air used up is approximately 1/5th of the whole (4).

Nitrogen to be given as the other constituent. (5)

(1) In studying section 1 the following substances could be used: water, alcohol, methylated spirit, benzene, paraffin, oil, salt, sand, chalk, sulphur, iron filings, copper, copper sulphate, naphthalene, paraffin wax.

(2) The determination of solubilities of solids and the construction of solubility curves are not required, but their interpretation is required. The conception that crystals cannot be obtained until a solution is saturated is expected.

(3) Carbon, sulphur, phosphorus, magnesium, zinc, copper, iron, lead, tin. It is expected that sodium will be burnt in air, but not in oxygen.

(4) Any suitable method will be accepted.

(5) The composition of air to be given approximately as:

1/5th oxygen

4/5th nitrogen with only small quantities of other constituents.

(6) Hydrogen peroxide is to be considered as a substance containing a high percentage of oxygen, some of which can readily be released by simple methods.

Laboratory preparation of oxygen from hydrogen peroxide by the use of manganese dioxide or by any suitable method (6). Uses of oxygen (7).

CHEMISTRY**SYLLABUS**

The burning of elements in oxygen (carbon, sulphur, phosphorus, calcium, magnesium, iron) and a first introduction to the activity series for metals (sodium, calcium, magnesium, iron, copper, lead).

Acidic and basic oxides examined by litmus.

Other methods of obtaining oxygen, e.g. by heat on mercuric oxide, lead dioxide, red lead oxide, potassium (Na) nitrate, and potassium (Na) chlorate (8).

The commercial preparation of oxygen from liquid air (9).

The composition of the air (10).

3. Water. The water cycle in nature. The burning of organic substances in air yields water and carbon dioxide with the release of energy. Energy release is typical of many chemical reactions.

Water, as a product of burning, may be an oxide of hydrogen, experiments to investigate this possibility. The action of the metals potassium, sodium, calcium, magnesium and iron (steam) on water, and a further reference to the metal activity series (11).

The use of hydrogen (12).

Synthesis of water by the preparing and burning of dry hydrogen in air (13).

The reduction of copper oxide and of lead oxides by hydrogen or coal gases.

NOTES

- (7) Uses of oxygen expected:
 (i) assistance in respiration;
 (ii) various oxy flames and metal cutting;
 (iii) tonnage oxygen in steel production.

(8) It should be stressed that nearly all the chemicals in this further preparation of oxygen are potentially dangerous.

(9) Details of the apparatus used for the liquefaction of air are not required but candidates should know that liquefaction is achieved by cooling and increase of pressure.

(10) The percentage of water vapour varies and is never really high, and the percentage of carbon dioxide is small. Argon, neon and helium should be mentioned.

(10a) The water cycle requires particular reference to be made to the circulation of carbon dioxide.

(11) The action of steam on magnesium is required, and the slow liberation of hydrogen from hot water is expected.

(12) Uses expected:

Fuels and flames,
 Haber process,
 Hardening of oils.

(13) The detail for determining the gravimetric composition of water is not required.

CHEMISTRY**NOTES**

Oxidation to be given as the addition of oxygen or the removal of hydrogen, and reduction as the removal of oxygen or the addition of hydrogen.

The electrolysis of acidulated water using platinum electrodes.

Conditions for the rusting of iron and methods of prevention (14).

4. Acids bases and salts

Characteristics of acids (15), bases (16) and salts. Common acids and bases, indicators.

- (14) Rusting, in this section, requires only references to oxygen and water. It should be regarded as slow oxidation.

(15) Acids to be illustrated using:

Hydrochloric, nitric, sulphuric, acetic, tartaric, citric, carbonic, sulphurous.

(16) Bases to be used:

Oxides and/or hydroxides of sodium, potassium, calcium, magnesium, zinc, copper, lead, ammonium.

(16a) Discuss carbonates as alkalis and bases.

The soluble hydroxides give alkaline solutions. Ammonium hydroxide for salt formation.

Reaction of carbonate with acids.

The action of dilute hydrochloric acid and dilute sulphuric acid (17) on:

(17) Other acids including dilute nitric are not necessarily excluded, but oxidising conditions are to be avoided. The action of nitric acid on metals is not expected as a method of salt formation.

(i) Metals, magnesium, zinc, iron, lead, copper (18).

(ii) Metallic oxides, magnesium, zinc, lead (monoxide only), copper.

(iii) Metallic hydroxides, sodium, potassium, calcium, magnesium, zinc, copper and ammonium.

(iv) Metallic carbonates, sodium, potassium, calcium, magnesium, zinc, copper.

(18) This section gives opportunity for further reference to the activity series.

CHEMISTRY

SYLLABUS

The preparation of insoluble salts by precipitation, e.g. silver chloride, barium sulphate, calcium sulphate, lead salts and many carbonates (19).

Methods of naming salts and the techniques for obtaining good crystals.

The action of heat on some salts

- (i) Hydrates; copper sulphate, washing soda (20).
- (ii) Carbonates of calcium, magnesium, zinc, copper, lead (sodium as above) (21).
- (iii) A few salts which show no decomposition, e.g. sodium and potassium chloride.

Water of crystallisation, deliquescence, efflorescence, drying agents, hygroscopic substances.

5. Sodium and calcium carbonates

Washing soda and baking soda and how to distinguish them.

Chalk (limestone and marble) quicklime and slaked lime, lime water. Uses of lime. (22).

Carbon dioxide, preparation, properties and uses (23).

Carbonic acid, carbonates and bicarbonates. At least one test for a carbonate or bicarbonate.

NOTES

- (19) Later sulphides are to be treated as insoluble salts.

- (20) For both, the action to be confined to loss of water of crystallisation.
- (21) The stability of carbonates on heating should be linked to the activity series.

- (22) Uses of lime expected:
 - (i) Agricultural for soil treatment.
 - (ii) Manufacture of cement, calcium carbide and glass (no practical details).
- (23) Uses of carbon dioxide expected:
 - (i) Use in the Solvay process for manufacture of sodium carbonate and bicarbonate.
 - (ii) Aerated drinks or mineral waters.
 - (iii) Fire extinguishers, no practical details.
 - (iv) Refrigeration.

CHEMISTRY

NOTES

SYLLABUS

Hardness of water and methods of softening (24). Simple introduction to soap (25). The formation of "fur".

- (24) Softening by
 - (i) The use of soap. The point to be made is that a lather cannot be obtained until the water is softened.
 - (ii) Boiling.
 - (iii) The use of slaked lime.
 - (iv) The use of sodium carbonate.
 - (v) The zeolite or permuntite process.

A distinction between temporary and permanent hardness is expected, but no other methods of softening are required.

- (25) Soap to be introduced as the soluble sodium salts of a few organic acids.

The manufacture of sodium bicarbonate and sodium carbonate by the Solvay process or by the solution of carbon dioxide in sodium hydroxide solution. (Technical details not required, but the essential chemistry is wanted.)

6. Further investigation of non-metallic elements

(a) *Carbon.* Charcoal, graphite, diamond. The combustion of various charcoals and of graphite in oxygen. Graphite is more difficult because of its higher ignition temperature. The diamond is even more difficult. They all burn to give carbon dioxide.

The combustion of organic matter in limited and in plentiful supplies of air (26).

Carbon monoxide, formation by reduction of carbon dioxide. Carbon monoxide burns to carbon dioxide, and when hot it is a good reducing agent.

The presence of carbon monoxide in coal gas, car exhaust fumes, fumes from badly ventilated fires, and in mines after explosions (27).

- (26) Illustrated by coal, wood, candle, petrol, diesel oil.

- (27) The poisonous nature of carbon monoxide should be emphasised.

CHEMISTRY

SYLLABUS

The carbon and oxygen cycles in nature. Similarities and differences between respiration in plants and animals and burning generally (28).

Photosynthesis simply.

Thermal decomposition of organic substances (29).

Origins of coal. Thermal decomposition to give coal gas, ammonia, tar, coke.

Approximate composition of crude coal gas and how the addition of water gas increases considerably its carbon monoxide content.

Water gas and producer gas (30).

(b) *Chlorine.* Common salt, hydrogen chloride, its preparation and properties. The properties of its solution in water and in toluene, including electrical conductance (31).

Chlorine, its formation by oxidation (32) and electrolysis of hydrochloric acid.

The properties (33) and uses (34) of chlorine.

NOTES

(28) Respiration involves slow oxidation at relatively low temperatures.

(29) Illustrated by coal, wood, paper, sugar,

(30) Technical details are not required but candidates should know that the formation of water gas absorbs heat energy (endothermic).

(31) The acid system is hydrogen chloride plus water but not hydrogen chloride plus toluene.

Properties of hydrogen chloride in dry Toluene:

- (i) Non conductor.
- (ii) White precipitate on passing ammonia.
- (iii) No reaction with zinc, magnesium and iron.
- (iv) Very little reaction with carbonates.

(32) Oxidising agents expected. lead dioxide, red oxide of lead, manganese dioxide, potassium permanganate.

(33) Chemical properties expected are its reactions with:

- (i) Hydrogen and hydrocarbons;
- (ii) Metals (Na, Mg, Zn, Fe, Cu);
- (iii) Non metals: phosphorus and sulphur but no direct action with carbon;
- (iv) Reducing agents such as hydrogen sulphide, sulphites, ammonia;

CHEMISTRY

SYLLABUS

NOTES

- (v) Water and dilute alkali solution;
- (vi) Bromides and iodides;
- (vii) Dyes, i.e. bleaching. The manufacture of bleaching powder is not expected.

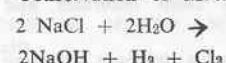
The study of bromine and iodine is not expected but reference to the 'halogen' family is expected, including reference to bromides and iodides in relation to note (70).

(34) Uses expected:

- (i) Manufacture of hydrochloric acid;
- (ii) Water purification;
- (iii) Bleaching;
- (iv) Manufacture of many organic compounds, e.g. chloroform, D.D.T., trichloroethylene, plastics.

(35) The electrolysis to illustrate:

- (a) Use of by-products;
- (b) Conservation of Matter



The electrolysis of brine at ordinary temperatures leading to the manufacture of sodium hydroxide (35).

Synthesis of sodium chloride and hydrogen chloride by burning the elements in chlorine.

The electrolysis of fused sodium chloride.

The chlorides of sodium, potassium, calcium, zinc, ferric, copper, lead and silver.

Two tests for a chloride, one for the dry solid and one in dilute solution.

(c) *Sulphur.* Occurrence and use (36). Crystallisation from melt and from solution.

(36) Uses expected:

- (i) Manufacture of sulphuric acid and bisulphites (see sulphur dioxide).
- (ii) Horticultural as a fungicide.
- (iii) Vulcanising of rubber.

CHEMISTRY

SYLLABUS

Hydrogen sulphide, combustible, a reducing agent (37) and a precipitant for many metallic sulphides (38).

Atmospheric pollution.

Sulphide ores, the sources of several metals (39).

At least one test for a sulphide. Sulphur dioxide. Its preparation from a sulphite. Its properties as an acid anhydride and as a reducing agent (37). Uses (40).

The conversion of sulphur dioxide to sulphur trioxide.

The manufacture of sulphuric acid by the contact process.

The properties of sulphuric acid (41) both pure and diluted, oxidising and dehydrating properties. Its use as a non volatile acid liberating more volatile acids from chlorides and nitrates.

One test for a sulphate and one test for a sulphite.

The general properties of non metals and their differences from metals.

(d) Nitrogen and its compounds (42).

The laboratory preparation of ammonia.

The reducing properties of ammonia and its great solubility. The basic properties of its solution.

Uses of ammonia (43) and its synthesis from nitrogen and hydrogen (44).

NOTES

(37) Chemicals reduced: KMnO_4^* , $\text{K}_2\text{Cr}_2\text{O}_7^*$, HNO_3 , H_2SO_4 , H_2O_2 , Cl_2 , Br_2 , moist SO_2 and the effect of air on its solution.

(38) PbS , CuS , ZnS .

*Equations not expected.

(39) Pyrites, zinc blende, galena, cinnabar.

(40) Uses of sulphur dioxide expected:

- (i) Manufacture of sulphuric acid, and of bisulphites for the paper industry.
- (ii) Bleaching and a food preservative.

(41) Properties expected:

- (a) Dilute, it behaves as an acid in every respect. The acid system is H_2SO_4 plus water.
- (b) Concentrated, it oxidises H_2S cold, and C and S when hot.
- (c) Dehydration of sugar, $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$ and flesh.

The action of conc. acid on metals is not expected.

(42) The laboratory preparation of nitrogen is not expected.

(43) Uses expected:

- (i) Manufacture of nitric acid.
- (ii) Preparation of ammonium salts, mainly amm. sulphate as a fertiliser.
- (iii) Refrigeration.
- (iv) Cleaning purposes.

CHEMISTRY

SYLLABUS

(44) Haber process. Technical details are not required beyond the use of pressure, temperature and a catalyst, and a simple outline of the preparation of the nitrogen and the hydrogen.

NOTES

- (45) Restricted to sulphate, chloride, nitrate, carbonate.
- (46) This reveals ammonia as a nitrogen hydride.

(47) The acid system is nitric acid plus water.

(48) Oxidation of H_2S , SO_2 , HCl and ferrous salts.

(49) The comparison should be limited to colour, solubility, acidity, action with oxygen and with ferrous sulphate.

A simple comparison of nitric oxide and nitrogen dioxide (49).

Nitrates, the preparation of potassium, sodium, ammonium and lead and the uses of potassium and ammonium nitrates in explosives and of ammonium nitrate as a fertiliser (nitro chalk).

At least one test for a nitrate (50).

The importance of nitrogen compounds to life, and the necessity for the "fixation" of atmospheric nitrogen.

The nitrogen cycle.

Fertilisers generally (51), there is a real necessity for nitrogen,

(50) Brown ring test, with no equation, or copper and conc. sulphuric acid.

(51) Fertilisers. Ammonium sulphate, potassium nitrate and superphosphates.

CHEMISTRY**SYLLABUS****NOTES**

phosphorus and potassium and a smaller need for calcium, magnesium, iron and sulphur. Adequate supplies of carbon, hydrogen and oxygen are always present, provided water is available.

7. The chemistry of some metals and of some of their compounds.

Potassium, sodium, calcium, magnesium, aluminium, zinc, iron, copper, lead.

The reactions of the above metals to air, water (steam) and acids (52).

Reduction of the oxides of the metals by carbon, hydrogen and coal gas.

The precipitation of the hydroxides of the metals including ferrous and ferric, and the amphoteric nature of zinc, aluminium, and lead hydroxides.

The effect of heat on the metallic hydroxides and its help in identifying the original metallic radical.

The effect of heat on washing soda, baking soda, common salt, chalk, limestone, the carbonates of lead, zinc and copper, magnesium sulphate crystals, green vitriol, and the nitrates (53).

Flame tests for Na^+ , K^+ , Ca^{2+} , Cu^{2+} .

The liberation of metals at the cathode by electrolysis. The general physical and chemical properties of metals and the chief uses of magnesium, aluminium, zinc, iron, copper, lead and the alloys, steels, brass, solder, type metals, duralumin. The simple reasons for the use of these alloys in preference to the metals from which they are made.

CHEMISTRY**NOTES**

8. Theoretical chemistry

Elements, compounds, mixtures, chemical and physical change (54).

The law of conservation of mass and the law of constant composition.

The Law of Multiple Proportions: simple calculations, but no experimental verification.

The nature of matter, evidence leading to particle theories, experiments to test these, diffusion and Brownian movement (55).

Definition of atom and molecule (56).

Symbols for atoms. Interpretation of the above two laws in terms of atoms. Dalton's conception of atoms and modifications made necessary by later discoveries, e.g. isotopes, radioactivity. The nature and limitations of a scientific law.

Relative masses of atoms (57), determined empirically by physical methods, showing isotopes.

Atomic weight scale. Combining weights. Percentage composition of simple compounds leading to the ratio of the numbers of atoms present. The deduction of simple formula and of valencies or combining numbers (58) (59) (60).

(54) This overlaps section 1.

(55) Some idea of the size of the particles should be conveyed.

(56) The atom to emerge as the smallest particle having the properties of the element.

(57) Atomic weights are to be taken for granted as they can be determined by physical methods. The experimental details are not wanted.

(58) It should be made clear that the relative masses of atoms can only be found chemically from the combining weights if the combining number of the element is known.

(59) Combining numbers, later called valencies in this syllabus, are found via the relative atomic masses (given by physical methods) and the combining weight (equivalent).

(60) The combining weights are to be accepted values as they have been determined by accurate experiments.

Experimental confirmation of the law of conservation of matter and the law of constant composition can be used to illustrate the concept of combining weights.

The traditional experimental determinations of equivalent weights, and numerous calculations concerning them are not intended.

CHEMISTRY

SYLLABUS

The idea of multiple valencies. The idea of the gram-atom and of gram formula (61).

Chemical equations.

9. The study of gases

The laws of Boyle and Charles (62), Gay-Lussac and Avogadro; volume relations exemplified by hydrogen chloride, steam, sulphur dioxide, carbon dioxide (63). Atomicity of hydrogen (64). The relation between the vapour density of a gas and its molecular weight (65). The gram-molecular volume as 22.4 litres when the conditions are 0°C and 760 m.m.

10. (a) Quantitative work on chemical equations

Standard solutions of HCl, HNO₃, H₂SO₄, Acetic (formula and equation given), NaOH, KOH, NaHCO₃, KHCO₃ and the relevant titration work and simple calculations (66).

Chemical equations and the quantitative information obtainable from an equation, including the volumes of gases evolved (67).

(b) Elementary treatment of the factors which can change the rate of a chemical reaction (68) (69).

- (i) Temperature;
- (ii) concentration;
- (iii) the presence of a catalyst.

NOTES

(61) Whatever the size and mass of the atom one gram-atom of all elements will contain the same number of atoms.

(62) It is not intended that questions should be asked requiring the experimental proof of Boyle's and Charles' but that questions requiring the application of these laws can be set.

(63) The volume relationships of ammonia, carbon dioxide and carbon monoxide to be given.

(64) Also the atomicity of chlorine and of oxygen, the latter from the volume composition of steam. The atomicity of other gases to be given.

(65) This will lead to the formulae of hydrogen chloride, steam, carbon dioxide, sulphur dioxide, the two latter by using the atomic weights of carbon and sulphur. Other gaseous formulae to be given.

(66) The concentration of solutions to be quoted in grams per litre and either normalities or molarities. Questions will be framed so that either normalities or molarities can be used.

(67) It should be established that an equation does not guarantee that a reaction will take place, nor does it give information concerning the conditions of the reaction.

(68) Comparative results only from such reactions as:

- (a) zinc or magnesium on dilute acids;
- (b) the decomposition of H₂O₂.

(69) Catalysts expected:

- (a) MnO₂ on H₂O₂;
- (b) Pt or V₂O₅ in contact process;
- (c) Fe (Fe₂O₃) in Haber process;
- (d) Ni in many hydrogenation reactions.

CHEMISTRY

NOTES

Energy changes during chemical reactions.

Experiments to illustrate the production and absorption of heat, electricity and light during chemical reactions, qualitative treatment only (70).

(70) Heat is evolved in many reactions but it is absorbed in water gas formation.

Light is evolved in many reactions, it is absorbed in photosynthesis and in photography and affects the reaction between hydrogen and chlorine.

Calorific value of fuels and foods.

The oxidation of food occurs slowly at body temperatures and fuels oxidise rapidly at high temperatures (71).

(71) It is not intended that lists of values should be taught but that there should be:

- (i) an understanding of comparative values;
- (ii) an appreciation of ignition temperatures.

11. Electrolysis

The conduction of electric current by substances (72).

Electrolytes and non electrolytes, simple ionic theory.

The three classes of substances:

- (a) those conducting when molten or in solution;
- (b) those that do not conduct;
- (c) substances not themselves conductors but which form conducting systems on contact with water (73).

Hydrogen chloride in toluene a non conducting system.

Qualitative comparison of conductances of molar solutions of strong and weak acids and bases (74).

Relation between current, time and mass (or volume) of substance liberated at an electrode. Quantity of electricity needed to liberate one

(72) Illustrated by salts, acids, bases, sugar.

The practical electrolysis of molten electrolytes is not expected.

(73) Illustrated by ammonia, acetic acid, hydrogen chloride, nitric acid, sulphuric acid.

(74) Illustrated by H₂SO₄, HCl, HNO₃, Acetic, NaOH, KOH, NH₄OH.

(75) This should be linked with combining numbers or valencies.

CHEMISTRY**SYLLABUS**

gram-atom of an element, and the realisation that some atoms require twice as much electricity to liberate them as do others (75).

The electron as an 'atom' of electricity. Electric current as a flow of electrons, anode, cathode, ion anion, cation.

Origins of the charges: atoms of metals lose electrons easily to give positive cations, atoms of non metals gain electrons giving negative anions (76). Ions as charged particles formed from atoms or groups of atoms, by loss or gain of electrons.

Electro-valency as the number of electrons gained or lost and its link with the quantity of electricity needed to liberate one gram-atom.

The electromotive series and its relation to the metal activity series.

Plating, purification of copper, liberation of gases, isolation of elements (sodium) (77). The study of a few specific systems (78).

NOTES

Simple calculations may be set.

(76) Evidence from conductance of metals.

(77) It is intended that the following points should be appreciated:

- (a) the p.d. and current used;
- (b) the need for the substance to be in the liquid state, or in solution, if ions are to migrate;
- (c) both solute and solvent can take part in an electrolytic process;
- (d) the need for attention to conditions for successful plating.

(78) It is intended that the following solutions (or systems) should receive special attention:

- (i) the electrolysis of acidulated water with platinum and copper electrodes;
- (ii) the electrolysis of cold brine with carbon electrodes, excluding formation of sodium hypochlorite;
- (iii) the electrolysis of copper sulphate solution with copper and platinum electrodes.

In all cases technical details are not required.

CHEMISTRY**SYLLABUS****12. Organic Chemistry**

In this section the following properties are expected:

Physical properties. Exact values are not expected but a knowledge of the gradual change in m.p., b.p., density and solubility in water as the molecular weight rises should be given.

Chemical properties**(79) Paraffins: burning and substitution with chlorine.**

The structure of simple organic compounds from the study of paraffins (79), olefines (80), alcohols (81) and acids (82), leading to a knowledge of the general physical and chemical characteristics of homologous series.

Laboratory preparation of (1) methane, (2) ethylene, and (3) acetic acid from alcohol.

(80) Olefines: burning, addition reactions with chlorine or bromine, hydrogen chloride, concentrated sulphuric acid and hydrogen.

(81) Alcohols: burning, reaction with sodium, phosphorus tri- or pentachloride and concentrated sulphuric acid to give an olefine, ester formation and oxidation in two stages to give an acid.

(82) Acids: salt and ester formation, reaction with phosphorus chlorides.**13. Structure of atoms, ions and molecules**

(i) Electron transfer. Usually from metallic to non-metallic elements with the formation of ions. Satisfactory as an explanation for bonding in simple electrolytes (83). Crystals formed from ions. Soluble and insoluble products.

Precipitation. Ionic equations.

(ii) Electron sharing. This is the usual method of bonding between non metallic elements. Sharing of electrons to form a covalent bond. Molecules (84).

(83) This transfer gives rise to electrolytes.

(84) Compounds formed by this bonding are non-conductors.

CHEMISTRY

SYLLABUS

A simple account of the atomic structure of the elements of atomic numbers 1-20 (i.e. up to calcium) (85). Isotopes.

An appreciation of the difference between normal chemical changes and nuclear changes, and of the energy liberation associated with the changes.

14. The Chemical Industry

Raw materials and their sources (86). The scope of the industry—heavy chemicals, fine chemicals, medicinals, fertilisers, glass, ceramics, plastics, detergents. (87).

The study of the chemistry of the following manufacturing processes:

(i) Iron and steel.

Blast furnace and manufacture of steel by the converter process, using oxygen (or by the Open Hearth process).

(ii) The Haber process and its importance to agriculture.

(iii) The contact process for sulphuric acid.

(iv) The electrolysis of brine at ordinary temperatures to give sodium hydroxide.

(v) The Solvay process for the manufacture of sodium bicarbonate and sodium carbonate. An application of differences in solubility.

Four-figure mathematical tables will be provided for this examination.

NOTES

(85) Candidates will be expected to reproduce the structure of the first twenty elements.

(86) The air, the sea, mineral ores, coal, petroleum.

(87) Only a simple review is intended.

BIOLOGY

Introduction

The object of the course outlined here is twofold:

- (1) To develop the teaching of Nature Study and Biology started in the lower forms of secondary schools to a point at which pupils who have no intention of studying Biology in the sixth form or, indeed, of entering the sixth form at all will have an intelligent appreciation of the living world of which they form a part. They should have a broad familiarity with the underlying uniformity of biological processes in both plants and animals and a knowledge of the basic differences between plants and animals. They should be capable of an elementary appreciation of the complex interrelationships between living organisms and their environment and of some understanding of the need for a deeper awareness by man of the ways of exploiting the living world without destroying and despoiling it.
- (2) To prepare pupils for more advanced studies of plants and animals in the two-year sixth-form course leading to the Advanced Level Examination in Biology and to University courses in Botany and Zoology.

Practical Work

Biology cannot be taught effectively from books and every opportunity must be taken to bring pupils into contact with living organisms, by demonstrations, by rearing animals and growing plants, by observing organisms in natural habitats, by collecting specimens, and by devising simple experiments to be performed by the pupils themselves. It is appreciated that there are many obstacles to the full achievement of this ideal—some of them peculiar to, or of exaggerated importance in Hong Kong. Nevertheless, efforts must be made to develop this dynamic approach and to this end certain questions will be set in such a way that they can only be answered effectively by pupils with a good background of practical work.

SYLLABUS

NOTES

1. The examination will consist of one paper (2½ hours) No practical question will be set. (See above).

2. Candidates will be expected to show knowledge of the main features of living organisms and their mode of life; in setting questions it will be assumed that such studies will have been based as far as possible on personal observation of actual living

See introductory remarks on practical work.

BIOLOGY

SYLLABUS

plants and animals both in the field and in the laboratory. Candidates will be expected to describe simple experiments, to draw conclusions therefrom, and to display a clear appreciation of the scientific method. Questions may be asked which are designed to test the powers of observation and reasoning of the candidates and their ability to handle simple experimental data.

3. The characters of living organisms: the differences between animals and plants. Protoplasm, the living cell. Conditions necessary for life. The structure, functions and reproduction of a simple plant and animal e.g. *Spirogyra*, *Amoeba*, *Hydra*.

4. Plant Physiology. (A knowledge of the Chemistry and Physics of the atmosphere and of water is assumed).

(a) Diffusion, osmosis. Absorption of water and mineral salts. Importance of turgor. Water or sand cultures.

(b) Movement of water up xylem vessels.

(c) Transpiration.

(d) Photosynthesis. Very elementary account of process. Use of food so made. General importance of photosynthesis.

NOTES

Use of control experiments. Significance of results. Need for numerous observations etc.

At an appropriate point in the course the idea of evolution should be introduced and the evidences for evolution outlined in a simple fashion. Similarly in discussing reproduction a brief reference to the fact of heredity should be made (use human examples e.g. haemophilia etc.) No questions will be set solely on evolution or heredity. The minute structure of cytoplasm and nucleus should not be taught.

Demonstrate these living organisms under the microscope. Opportunity to point out teeming microscopic life of ponds, etc.

To be closely co-ordinated with section 6.

Use both artificial cell and living material.

Movement of water-soluble dyes.

Experimental demonstration of loss of weight.

Use of cobalt chloride paper. Effect of external factors on rate of water loss.

Potometer—explain limitations.

Experimental demonstration of need for light. Carbon dioxide, chlorophyll. Formation of starch and liberation of oxygen.

BIOLOGY

NOTES

Experiments on gaseous exchange and heat production. Anaerobic respiration of seeds to be studied in outline only.

Regions of growth of root and shoot. Geotropism, phototropism, hydrotropism, opening and closing of flowers. Make use of local abundance of *Oxalis*, *Drosera*, *Mimosa pudica*.

Experiments on effects of water, oxygen temperature and light.

Simple experiments on physical and chemical features of soils. Soil erosion in relation to local environment.

Demonstrate growth of moulds and bacteria on artificial media, if possible. Microbial population of atmosphere by exposing plates of nutrient medium.

5. The biology of saprophytes, e.g. a mould, and parasites; a plant parasite, e.g. Dodder, an animal parasite (liverfluke or tapeworm) and a brief consideration of the problems of effective control. This should include a brief consideration of micro-organisms as agents of disease and decay; principles of sterilization and food preservation; immunization; industrial and agricultural importance of micro-organisms. Nitrogen cycle (including nitrogen fixation).

6. The external features and morphology of the organs of a flowering plant. The functions of these organs so far as they can be ascertained by observation and simple experiment. The main phenomena of the life history of a flowering plant.

Use hand lens only—Pupils should study several local examples, e.g. Antirrhinum, Chickweed. It would be valuable if these could be grown from seed to maturity keeping detailed notes. Use these plants as material for other aspects of course, e.g. physiology, seed germination, etc. Brief mention of internal structure of leaf, stem and root in relation to physiology section. If possible, demonstrate sections with microprojector but do not expect pupils to memorize detailed anatomy of these organs.

Detailed mechanism of pollination in not more than 2 insect-pollinated and 1 wind-pollinated flower.

BIOLOGY

SYLLABUS

Fertilization, the major changes following the process.

Fruit and Seed dispersal.

Germination.

Organs of vegetative propagation such as Rhizome, Stem Tuber, Corm, Bulb.

Characteristic features of three local trees/shrubs throughout year.

7. (1) Consideration of a mammal as a living, whole organism in relation to its environment. The general morphology, anatomy and physiology of a mammal to include.

(a) Main morphological and structural features including the general arrangement of the internal organs. Consideration of the skin.

(b) the general plan of the skeleton; joints as illustrated by the shoulder/hip and elbow/knee and the arrangement of muscles and their attachment to the skeleton to achieve movement. The structure of the atlas, axis, cervical, thoracic and lumbar vertebrae in relation to their functions. Simple treatment of joint surfaces.

(c) Structure of a tooth and its insertion in the jaw bone. Incisors, canines, premolars and molars. Relation of dentition to diet as illustrated by man, a herbivore and a carnivore.

NOTES

Excluding the microscopic processes of maturation and union of the sexual elements and of development.

2 examples each of wind and animal dispersal, one example of self dispersal and one example of water dispersal, e.g. Balsam, Chinese Cabbage, Torenia, Tobacco.

At least one example each of epigeal and hypogaeal germination, e.g. Maize, Broad Bean, Castor Oil, Green Gram Bean, etc.

At least one local example of each chosen for economic or ecological significance, e.g. Lotus, Iris, Ginger, Irish Potato, Gladiolus, Onion, Amaryllis, Zephyranthes. Compare and contrast vegetative reproduction and reproduction by seed.

e.g. S. China Pine, Camphor, Bauhinia variegata, Delonix, Rhodomyrtus, Melastoma.

e.g. Rat, rabbit or guinea pig with reference to other mammals especially man when appropriate.

These should be demonstrated on a living specimen and by dissection of a freshly killed specimen.

Details of the structure of the skull not required nor of the parts of the girdles. Vertebra should be regarded as composed of a body (centrum) with arches, neural spine, transverse processes and processes for articulation. Names of the articular processes not required. The relationships of the bones should be demonstrated by means of an articulated skeleton.

Discussion of care of teeth.

BIOLOGY

SYLLABUS

(d) The alimentary canal. Food substances and diet. Digestion including the functions of the liver and pancreas. Absorption, transport and utilization of digested food; elimination of waste. The function of the liver in general body metabolism.

(e) The main features of the circulatory system. The structure and functioning of the heart. Blood vessels to include the structure and function of veins, arteries, portal vessels, capillaries and brief mention of lymphatics.

(f) Respiration. The respiratory organs and the mechanism of breathing. Tissue respiration. The role of oxygen in the liberation of energy for the activities of the living body.

(g) Excretion by kidneys, sweat glands and lungs. Elementary treatment of the structure of the kidney and of filtration and reabsorption.

(h) Structure and function of skin.

(i) Regulation of body temperature and importance of the maintenance of constant body temperature.

(j) The nervous system. A simplified account of the brain and spinal cord. Reflex action and how it differs from voluntary action. The principal sense organs; their positions and functions.

Structure of the eye and ear. The use of spectacles for the correction of long and short sight.

NOTES

Tests for reducing sugar, starch, protein (one test only) and fats should be carried out by the candidate. Also, if possible the action of ptyalin, rennin and pepsin should be studied experimentally. Names of specific enzymes will only be required in the case of ptyalin, rennin, and pepsin but candidates should understand that specific enzymes in the small intestine act on proteins carbohydrates and fats to complete the digestion of foodstuffs.

Blood should be examined microscopically and shown to be a specialized connective tissue. Names of valves of heart not required. Names will be required only of the major veins and arteries of the heart, kidney and liver. Capillary circulation in the web of frog's foot or tail of tadpole to be shown under the microscope.

Kidney should be treated as comprising a system of tubules commencing in a glomerulus and terminating to empty into the ureters.

A section of skin should be examined.

Heat gain needs consideration as well as heat loss.

Only the external structure of the brain need be considered though reference should be made to the distribution of white and grey matter. Reflex action should be illustrated experimentally. The ear should be treated as consisting of a cochlea sensitive to vibrations and semicircular canals sensitive to position. Behaviour should be considered, especially a contrast between the more "instinctive" and more intelligent types; questions on this topic will not be set. Consideration should be given to care of eyes.

BIOLOGY

SYLLABUS

NOTES

(k) the co-ordination of body functions by means of the endocrine system.

(l) The reproductive organs and a general outline of the development, nutrition, respiration and birth of the embryo.

The reproduction and general development of a frog and a bird for comparison and contrast with the mammal, especially in connection with the type of fertilisation and degree of parental care.

7. (2) External features, habits, movements and life history of an egg-laying bony fish (including gills), a frog, a bird, and a mammal.

7. (3) Insects. External features of cockroach to illustrate the general characteristics of insects. Outlines of the life history, mode of life, and the economic importance (to include spread of disease where applicable) of cockroach, cabbage white butterfly, mosquito, house fly and hive bee.

8. Natural History. The candidates will be expected to show knowledge from personal observation in the field of some of the commoner animals and plants of Hong Kong, also of the animals and plants of any one suitable habitat such as a rice-field, lotus pond, duck pond, ravines and shady banks, waterfalls and stream, a balanced aquarium, a sea shore, or a garden, from the point of view of the inter-relations of the species found there and their adaptations to the conditions of their environment. The life histories and habits of at least four animals and four plants from the chosen area should be known.

Brief survey of the position and function of the main ductless glands. An example of the integrative relationship between the nervous system and an endocrine organ should be given.

Details of cell division, and the anatomy of the embryo not required. Embryological details not required.

Candidates should study living examples and should be encouraged to record their observations. They should consider how the animals are adapted to their environment and type of life.

Detailed knowledge of the individual mouth parts and appendages not required.

Candidates should make their own observations in the field supplemented by living specimens in the laboratory. Regular visits to Botanical Gardens to observe both plants and animals are suggested. Microscopic animals and bacteria are not included.

DOMESTIC SUBJECTS

Note: All materials for the practical tests must be provided by the schools concerned.

The Examination will be recorded as Domestic Subjects (Cookery) or Domestic Subjects (Needlework).

Candidates who wish to offer Needlework and Cookery may sit for Domestic Subjects (Cookery) and Dressmaking.

Candidates may not offer Domestic Subjects (Needlework) and Dressmaking.

The Examination will consist of:

Part I. A $2\frac{1}{2}$ hour written paper consisting of sections:

- A. Housecraft
- B. Food and Cookery
- C. Needlework.

Candidates will be required to answer questions from Section A (Housecraft) and questions from either Section B (Cookery) OR Section C (Needlework). A choice of questions will be given in each section. A compulsory question will be included in each of sections B & C.

Part II. A Practical Test in either Cookery or Needlework.

Syllabus

PART I

A. Housecraft

1. Simple kitchen First-Aid.
2. The working, use, care, cleaning of kitchen equipment—sinks; refrigerators; gas, electric, oil and charcoal stoves.
3. Choice, care and cleaning of kitchen tools and utensils—metal, wood, plastic, china and glass.
4. Floor surfaces and coverings—care and cleaning of tiles, polished wooden floors, coconut matting and carpets.
5. Wall surfaces—cleaning and care of paint work, varnished and distempered surfaces.
6. Choice, care and cleaning of household glass, metal, plastic, wood and china.
7. Order of work in the home and removal of dust, dirt and stains.

8. Laying and clearing of meals; washing-up.
 9. Storage of perishable and non-perishable foods in the home.
 10. Choice of suitable materials for soft furnishings in the home i.e. curtains, loosecovers, bedspreads.
 11. Storage of clothing (including shoes), household linen and soft furnishings when not in use; prevention of damage by household pests. Simple methods of repairing clothing and household linen, including patching and darning.
 12. Laundrywork—elementary knowledge of the properties and treatment of linen, cotton, wool, silk, and man-made fibres i.e. nylon, terylene. Washing, starching, ironing of personal clothing and household linen.

Simple stain removal—ink, fruit, lipstick, beverages, iron mould, blood, mildew. Special laundry care for invalid and baby's clothes.

 13. Danger and prevention of flies, rats, cockroaches, lice and fleas.
 14. Care of children 3-5 years of age. Feeding. Personal habits of hygiene.
Daily routine regarding sleep, rest and play.
 15. Adapting a bedroom into a temporary sick-room.
Care and cleaning of this room. Choice, preparation and serving of food to invalids.
How germs enter the body.
Infectious diseases—prevention of smallpox, typhoid, T.B., malaria, cholera.
- A wide selection of questions will be set on the Housecraft syllabus.
- B. Food and Cookery**
1. An elementary knowledge of the nutritive value of foods—milk, cheese, eggs, meat, fish, vegetables, fruits, cereals and soya products.
 2. Classification of foods according to their functions—body building, energy giving, protective.
 3. Planning balanced menus for different meals in the day for health, economy, variety and ages.
 4. Marketing, choice of foods and approximate cost.
 5. Methods of cooking in Practice and Theory, including boiling, steaming, stewing, roasting, baking, grilling and frying. Illustrated by simple dishes either European and/or Chinese.
 6. Soups; meat dishes; fish dishes; vegetable cookery; salads; fruit dishes; puddings and cold sweets; cakes; pastries; sauces; beverages; vegetarian dishes, e.g. use of eggs and cheese (European dishes) or use of vegetable proteins (Chinese dishes).
 7. Basic proportions and rules for success of the different classes of pastries (short and flaky or rough-puff); cake mixtures (rubbed-in, creamed, whisked and melted); soups; scones, batters and sauces.
 8. Convalescent cookery.
 9. Simple cookery for occasions such as picnics, tea parties.
- C. Needlework**
1. Choice, use and care of needlework tools including sewing machines and pressing apparatus.
 2. Elementary knowledge of different fabrics used, including their reaction to moisture and heat.
 3. Purchase of materials, approximate costs, widths and quantities required for making different garments.
 4. Use of commercial patterns and simple pattern drafting to give a basic knowledge of garment construction. Adaptation of patterns for making garments to fit one's own measurements, including a dress, skirt, blouse, knickers and/or shorts.
 5. Selection and care of clothing—colour schemes and styles to suit personal appearance and the figure. Wardrobe planning.
 6. The stitches and processes used in neatening and joining edges; seams, hems, bindings, facings, pipings, shell edging and application of lace; scalloping.
 7. Taking in fullness—darts, pleats, tucks, gathers and smocking.
 8. Openings—neck openings, sleeve openings, (e.g. bound, continuous strip, faced, shaped-facing); skirt and dress plackets.
 9. Setting-in sleeves—plain, shirt blouse sleeve, gathered sleeve, puff sleeve.
 10. Attaching collars—Peter Pan, straight collar, Chinese collar.
 11. Sewing on fastenings, including buttons and button holes, loops, eyelet-holes, patent fasteners and tapes.
 12. Simple embroidery stitches.
 13. Knitting—ability to read and follow pattern directions. Knowledge of basic stitches.

PART II

Practical Cookery

This will consist of a number of alternative practical tests, one of which will be allocated to each candidate on a day before the examination. Candidates will then be required within a period of 60 minutes to plan how they would carry out their tests and to hand in a list of ingredients required.

On a subsequent day, they will be allowed 2 hours to carry out practical work in the presence of an examiner. Each practical test will be such as a candidate may be expected to complete within two hours, and the amounts cooked will normally be sufficient for one to three persons.

Practical Needlework

Candidates will be allowed 2 hours to carry out an unprepared practical test.

Also finished articles which must have been worked by the candidate during the previous two years of the Needlework Course must be shown to the examiner. This work must include:

- (i) One garment to show skill in both hand and machine work. This may include any decorative stitchery if applicable to the garment.
- (ii) One garment to show as many processes as possible.
- (iii) One garment or article repaired.
- (iv) A hand-knitted garment.

Course work and note-books may be required to be submitted during the examination.

MUSIC

The examination will consist of three parts as follows:

1. Aurals (30 minutes)
2. Rudiments and Set Works (3 hours)
3. (a) A Practical Test, vocal or instrumental.

OR

- (b) General Musical Knowledge (2½ hours)

All candidates will attempt Papers 1 and 2 but make a choice of (a) or (b) in Paper 3.

A detailed Syllabus is given below:

Paper 1. Aural Tests

- (i) Candidates will be required to write on a monotone prefixing the necessary time signature, a short simple rhythmical passage beginning on the first beat of a bar. After indicating the speed at which the music moves, the Examiner will play the passage twice. After a short interval he will play it a third and fourth time.
- (ii) Candidates will be required to write from dictation a short melodic phrase, beginning on the first beat of a bar, in either a major or a minor key. Before playing the passage, the Examiner will indicate the speed at which the pulse of the music moves. The key will be named, and the key-note and tonic chord sounded. The phrase will then be played once throughout. It will then be played twice in sections, at short intervals of time, and finally the phrase will be repeated in its entirety.
- (iii) Candidates will be required to describe (e.g. 'perfect 5th') intervals which are diatonic in major keys. Two such intervals will be given without the sounding of the key-notes. Each interval will be played twice.
- (iv) Candidates will be required to recognize and name any of the following cadences—perfect, imperfect, plagal, or interrupted—occurring in a musical example in a major key played by the examiner. The example will contain two cadences. After the tonic chord has been sounded the example will be played through with due deliberation three times.

- (v) Candidates will be required to recognize the three principal chords of a major key, (tonic, sub-dominant, and dominant). The key will be named and the tonic chord sounded. (Root position and first inversion will be used.) After this the example will be played four times at a reasonably slow pace. The example will contain up to five chords beginning with a chord in root position.
- (vi) Candidates will be required to recognize and name simple changes of key. Three examples will be given, each starting from the same tonic key, and containing one modulation only. Modulations will be limited to the dominant, sub-dominant, and relative major or minor keys. After the key has been named and the tonic chord has been sounded, each of the three examples will be played through twice.

Paper 2. Rudiments and Set Works

- (i) Rudiments: Candidates will be required to show a general knowledge of rudiments including:
 - (a) All major and all minor harmonic and melodic scales with technical names of the degrees of the scale and key signatures.
 - (b) Intervals and their inversions formed on each degree of the major and harmonic minor scales.
 - (c) Completion of incomplete bars with rests.
 - (d) Simple and Compound times, with time signatures.
 - (e) Barring of unbarred phrases.
 - (f) Musical terms in common use including any from set works.
 - (g) Transposition of a given melody up or down a specified interval.
 - (h) Signs and ornaments viz, trill, turn, mordent, acciaccatura and appoggiatura.
 - (i) Candidates will be required to write from memory in any key up to four sharps and four flats in the treble clef, one of four given national tunes:
 1. The Lass of Richmond Hill
 2. Afton Water
 3. It was a lover and his lass
 4. Robin Adair
 - (j) To write a melody above or below a given one in any key containing not more than two sharps or two flats. The added part to keep within the compass of the voice named and may be mainly note against note with an occasional passing note.

(ii) Musical History and Set Works

Candidates will be required to have a knowledge of the works and of the historical position and importance of the following composers, with special reference to the branch of music indicated. They will also be required to show a detailed knowledge of the set parts of the work or works named and must be prepared both to quote and to identify important themes (of which a choice will be given) from the chosen portions of the particular works given below. A choice of three of the following items, one from each sections:

- | | |
|------------------|--|
| (a) Vocal | The Creation—Haydn |
| | (i) Solo—"Rolling in foaming billows" |
| | (ii) Chorus—"Awake the harp" |
| (b) Instrumental | Pianoforte: "Children's Corner Suite"— Debussy "Serenade for the Doll" and "The snow is dancing" |
| | (ii) Chamber Music: Quintet in A, K. 581—Mozart (<i>4th Movement</i>) "Allegretto with Variations" |
| (c) Orchestral | Symphony No. 6 in B minor, Op. 74—Tchaikovsky—(<i>2nd Movement</i>) "Allegro con grazia" |
| | (ii) Suite: Harry Janos, Op. 15 by Kodaly "Prelude" and "Song" |

Paper 3a. Practical Test

All candidates choosing this section will be required to sing tests written in staff notation in major or minor keys, using sol-fah syllables.

The studies, songs and pieces mentioned in this memorandum are to be regarded merely as indications of the degree of difficulty to be aimed at. They are not to be regarded as a definite prescription.

- I. Solo Singing. (*Note.* At least one of the pieces in (A), (B) & (C) to be sung from memory.) Each candidate to prepare:
 - (A) A simple aria by Bach or Handel, e.g. "Come unto Him" (Handel).
 - (B) A lyric song-Schubert, Schumann etc., e.g. "Who is Sylvia?" (Schubert).
 - (C) A folk or national song.
 - (D) Scales: Major and both forms of minor to be sung to sol-fah names and vowel sounds. Arpeggios: major and minor, to the tenth.
 - (E) Sight Reading: a short and simple song to be sung at sight.

II. Pianoforte. (*Note.* At least one of the pieces in (A), (B) & (C) to be played from memory.)

- (A) Bach or Handel: a simple dance form from the suites or a two part invention.
- (B) Haydn or Mozart: a movement from a sonata.
- (C) An imaginative piece by Schubert, Mendelssohn, Grieg, Macdowell, or a modern writer.
- (D) Scales: major, both forms of the minor and chromatic in similar motion with separate hands and together. Arpeggios: major and minor chords with their inversion, in extended form, with separate hands and together.
- (E) Sight Reading: a short and easy piece, or a simple accompaniment to be read at sight.

III. Violin. (*Note.* At least one of the pieces in (A), (B) & (C) to be played from memory.)

- (A) A Kreutzer Study No. 3 in C major or No. 11 in E major.
- (B) Concertino in A minor, Accolay, or a simple movement from a Handel or Corelli sonata.
- (C) Andantino, Martini-Kreisler (No. 2) or an example from the romantic or from the contemporary period.
- (D) All major and minor scales (both forms not beyond F natural in the 5th position ascending and descending to the extent of two octaves, and with detached and slurred bowing (one octave to a bow).
- (E) Sight Reading: short and easy piece in a major or minor key, the signature not exceeding three sharps or three flats.

IV. For other instruments, a syllabus will be drawn up when necessary.
Note. Candidates requiring accompaniment must provide their own accompanist and the teacher may act as such (the Examiner will not); but the accompanist may remain in the room only whilst actually engaged in accompanying. Candidates are recommended to provide themselves with music stands if they require them.

OR

Paper 3b. General Musical Knowledge (2½ hours)

This paper will consist of two sections (a) and (b) and candidates will be required to answer questions from both sections.

(a) This section will consist of a *compulsory* question on the *set composer* and a choice of additional questions to test the candidates' general knowledge of the main stream of music from the Tudor period to the present day. Candidates will not be expected to have studied the development of music within the period in detail; the questions will be framed to test ability to place the landmarks of the period in their right perspective. The set composer is Schumann.

(b) *Special topics*

Candidates will be required to select *ONE* of the following list of topics.

- (i) The Orchestra
- (ii) Keyboard Music
- (iii) Opera and European Song
- (iv) Musical Forms
- (v) Choral Music

The syllabuses for these special topics are as follows:

(i) *The Orchestra:*

The standard instruments of the Modern Orchestra; their characteristics and methods of tone production.

The Bach Period:

Instruments in use; methods of using them orchestrally and in combination with voices.

The Period of Haydn and Mozart:

Emergence of strings as the foundation of the modern orchestra. The consideration and use of the various "families" of instruments.

Beethoven and the Orchestra:

Beethoven's use of the instruments of the orchestra in his compositions, his contribution to the development of the orchestra.

Romantic Period:

The orchestra from Beethoven to the present day.

(ii) *Keyboard Music:*

The principles of tone production of: Virginals, the Spinett, Harpsichord, Clavichord, Pianoforte, Organ. Music of the English Virginalists. Keyboard music of Purcell, D. Scarlatti, Bach, Handel. Sonatas of Haydn, Mozart. Beethoven's develop-

ment of the pianoforte Sonata—John Field's Nocturnes—Chopin, style and texture—Schumann, descriptive pieces—Debussy—impressionist effects (e.g. La Cathedrale Engloutie). The Organ—Bach's Works, Chorale Preludes, Preludes and Fugues, Mendelssohn's Sonatas. The French School. The Pianoforte Concerto.

(iii) *Opera*

The musical and dramatic ingredients of opera. Purcell; The Beggar's Opera; Mozart; Britten. Outlines of nineteenth century opera.

European Song

Folk Songs of the British Isles. Nationalism in folk song—distinctive characteristics. (e.g. England, Ireland, Spain) Arias from opera and oratorio.

The flowering of German Song; the song (words, melody and accompaniment) as an entity. English Song in the 20th Century.

(iv) *Musical Form*

1. Accent, Time, Rhythm; Phrases and sentences, Binary and Ternary design.
2. Fugue, Canons, Round.
3. Development of the commoner 17th century and 18th century dance forms.
4. Rondo, Sonata, Symphony, Concerto, Ballet, Programme Music.

(v) *Choral Music*

The concerted vocal music of the polyphonic period c. 1550-1625; general characteristics of style; Palestrina and Vittoria; the English madrigal school, church music of Tallis, Byrd Gibbons. Seventeenth-century choral music; Purcell Choral music of Bach and Handel. The later history of oratorio and other full-scale choral music as illustrated by the works of Haydn, Mozart, Mendelssohn, Berlioz, Verdi, Brahms and Elgar. Choral Music of the 20th Century.

ART

General Instructions

- (a) Any medium may be used, with the exception of oil paint, provided that it is suitable for the subject. All paints used must be of adequate quality, and, if coloured crayons or chalks are used, they must have a range and quality comparable with paints. (Dry pastels and charcoal, if used must be fixed by the candidate with a spray before handing in the work). Monochrome may be used where specifically permitted by the regulations for each paper.
- (b) Candidates must use their judgement in regard to the size of a drawing or painting. In all cases credit will be given for good composition.
- (c) The use of ruler, compasses, and other instruments for all, except the Design Paper, is not allowed. In the Design Paper candidates may use instruments, but are advised to restrict that use to a minimum.
- (d) Candidates must write their number small, but clearly legible, upon the top right hand corner of the paper. The number must not interfere with the design.
- (e) Candidates must answer Paper I, and any other two Papers.

Paper 1

One question only must be chosen from Paper 1 by all candidates.

DRAWING AND PAINTING FROM NATURE

Question (1) *Drawing from the figure.* (2½ hours including rests for the model).

A model, who may be either a boy or a girl, will be posed in a simple way, wearing either school uniform or plain everyday costume. Candidates may concentrate on the whole figure and monochrome or colour may be used. If painted, (either in monochrome or in colour), the background may be included.

or Question (2) *Plant drawing.* (2½ hours)

Candidates will be required to make a drawing, or a painting, in monochrome or colour, from a plant, spray of foliage, flowers, or leaves. These may be treated freely, or as botanical specimens, but must show the natural growth and character. The vase, pot, or other container in which the plant is set up, *must not be drawn*.

or Question (3) *Flower, tree, bird, insect and fish painting (Chinese style).* (2½ hours)

Candidates are required to make a picture from a given specimen. Special emphasis will be laid upon composition.

Paper 2

One question only may be chosen from Paper 2 by all candidates.

Question (1) *Composition from objects.* (3 hours)

Candidates will be required to make a picture including specified objects which shall be in sight during the examination. The objects are intended only to suggest the basis of a picture to which other and imaginary elements may be added. Treatment may be of any kind and pictures may be either chiefly illustrative, or decorative in character. Colour must be used.

or Question (2) *Composition.* (3 hours)

Candidates will be required to make a picture on one of five or six different themes. These will include a selection of both everyday and imaginative scenes. Figures both human and animal, may be included in landscapes, seascapes, interior and other scenes.

or Question (3) *Landscape Painting in the Chinese Style.*

Candidates are required to make a picture based upon a given subject. There will be a choice of these. Emphasis will be laid upon genuine observation of nature.

Paper 3

One question only may be chosen.

Design and Crafts. (3 hours)

Question (1) Candidates will be asked to make a pattern design in colours, (the number of colours will be specified), suitable for printing upon fabric or wallpaper. The Examiners will specify the use of the pattern, and candidates may be asked to make a sketch of it in use.

or Question (2) *Poster Design. Bookjacket Design. Christmas Card, Notice, Invitation Card or Emblem.*

Candidates will be asked to design one of the above. (alternative questions will be set in each). The lettering of the design chosen need not necessarily be finished, but enough must be shown to indicate how the complete design would appear.

or Question (3) *European Calligraphy.*

Candidates will be required to design, with an illuminated capital letter and other decoration as necessary, a short piece of writing, either prose or poetry, which will be given. The writing must be completed with the chisel edged quill, reed, or pen, and as much of the decoration as time allows, must be completed. Colour is to be used in the decorative elements.

or Question (4) *Chinese Calligraphy.*

Candidates will be required to copy from given passages of Chinese literary works.

(a) About 50-60 characters in (Kai Shu) 楷書 Size 1½ ins. sq.

(b) About 180-200 characters in (Kai Shu) 楷書 Size ½ in. sq.

Paper 4

History of Art. (2 hours)

An outline knowledge of the following periods will be assumed and questions will be set to cover the ART & ARCHITECTURE of: (i) Egypt, Greece, and Rome (ii) European Mediaeval Art (iii) Renaissance Italy (iv) The 18th and 19th Centuries & Modern Art (v) Chinese Art & Architecture.

POTTERY

The Examination will consist of a theory paper of 2 hours duration, consisting of 2 sections, and candidates must answer questions from both, and a 3 hour practical test.

1. (a) Theory: Section I

The theoretical paper will include special questions to test the candidate's understanding of the following:

- (i) Clays, nature type and uses, conditioning, handling and storage.
- (ii) Working of clay. The making of pinched, slab, coiled and thrown pottery. Tiles, and moulded pottery shapes. Hand modelling and simple ceramic sculpture.
- (iii) Drying, hardening, and biscuit firing.
- (iv) The preparation of slips and glazes.
- (v) The application of all forms of decoration.
- (vi) Glaze firing.

(b) Theory: Section II

This section will consist of questions to test candidates' knowledge of:

- (i) The historical background and significance of pottery making.
- (ii) The history of Chinese ceramics. (Shang dynasty to present day).
- (iii) Modern pottery design and manufacture.

2. Practical Test:

Candidates will be expected to have mastery over all the simple techniques of hand made pottery and modelling, and be able to demonstrate their ability in making various pottery and modelled shapes. They will also be expected to decorate these shapes, and to have full awareness of the technical aspects of hardening and firing.

EMBROIDERY

The examination will consist of two papers.

1. A practical test of 3 hours duration, and
2. A theory paper of 2 hours duration, which will consist of two Sections and candidates will be required to answer questions from both Sections.

Paper I: Practical

Candidates will be expected to have a full knowledge of all types of embroidery, embroidery design, colour and stitches. They should be able to produce a design in colour and name the stitches used, and know the materials and threads suitable for any finished article.

Candidates will be required to carry out a piece of embroidery on a given subject.

The school should retain final year practical course work for inspection by the examiner, as necessary.

Paper II: Theory

Section I

1. The choice, care and use of embroidery tools.
2. Stitches used in embroidery, which should include the following:

Back stitch	Herringbone stitch
Stem stitch	Couching
Cross stitch	Blanket stitch
Buttonhole stitch	Fly stitch
Chain stitch	Chevron stitch
Feather stitch	Cretan stitch
French knots	Pekinese stitch
3. The combination of stitches to form patterns.
4. The types of materials suitable for the various kinds of embroidery.
5. Embroidery design and colour.
6. Quilting: English and Italian; and the materials, methods and stitches used.

7. Drawn thread work, needle-weaving, shadow work, smocking, applique, Assisi, etc.
8. Use of embroidery in clothing, furnishing and decoration.

Section II

1. Candidates should have a knowledge of natural and synthetic fibres, and know the elementary facts about the origin and construction of woollens, cottons, linen, silk, rayon, nylon, etc.
2. A knowledge of the simple outline of the History of embroidery of England or China will be required.
3. A study should be made of the Bayeux Tapestry.

WOODWORK

The examination will be in three parts and the candidate must satisfy the examiners in each part.

(a) Drawing (1½ hours)

(b) Theory (1½ hours)

(c) Practice (3 hours)

(a) DRAWING

(i) Candidates will be tested for their ability to read and make working drawings, properly dimensioned and to scale, in orthographic projection including sections parallel to the vertical or horizontal planes. British Standards on Engineering Drawing Office Practice No. 308A of 1958 or later is the reference standard.

(ii) Ability to make and read detail drawings of joints, fittings and simple tools in isometric, and oblique projection. The questions will test the candidate's capacity to apply his knowledge of design, draughtsmanship and workshop practice to the creation of simple wooden constructions.

(b) THEORY. The questions will test the candidate's knowledge of the following:—

(i) Tools: The construction, maintenance, storage, and sharpening of the woodworker's common tools.

(ii) Timber, its growth, conversion, seasoning; difference between hard and soft woods. The common types available in Hong Kong and their characteristics and identification. Timber defects and diseases.

(iii) Other materials required in woodworking, such as glue, nails and screws.

(iv) Woodworking operations connected with the production of boxed or framed constructions using simple common joints chosen from mortice and tenon, dovetail, housing, halving and edge joints. Assembly and finishing of woodwork for simple staining and polishing.

(v) Fitting of locks, hinges and other simple fittings.

(vi) Elementary design applied to woodwork constructions including a knowledge of the effect of the use of modern plywoods, laminated boards and hardboard in such constructions.

(c) PRACTICAL TEST. The course work should have familiarized the candidate with the practical aspects of the above theoretical work and built up his skills so that he will be in a position to read working drawings and execute a piece of woodwork involving the planing, shaping, jointing, gluing, nailing or screwing of wood to produce an accurately sized and shaped construction in the specified time.

For the practical examination, candidates will be given a test involving any or all of the above operations. The test may be carried out in the school workshop or at a specified centre.

N.B. The school should retain final year course work in drawing and practical work for inspection by the examiner.

METALWORK

The examination will be in three parts and the candidate must satisfy the examiners in each part.

- (a) Drawing (1½ hours)
- (b) Theory (1½ hours)
- (c) Practice (3 hours)

(a) DRAWING

- (i) Candidates will be tested for their ability to read and make drawings properly dimensioned and to scale in orthographic projection including sections parallel to the vertical and horizontal planes. British Standards on Engineering Drawing Office Practice No. 308A of 1958 or later is the reference standard.
- (ii) The candidate must be able to read and make simple isometric and oblique projections of the tools and simple practical processes involved.
- (iii) Standard methods of representing bolts, nuts, screws, threads, and developing the surfaces of the simpler geometric solids for sheet metal work.
- (iv) Simple design work involving choice of dimensions and materials for simple assemblies normally found in a workshop.

(b) THEORY

- (i) Tools: The construction, maintenance, storage and sharpening of the common metal workers' tools including the simple lathe.
- (ii) The common ferrous and non-ferrous metals, their nature, extraction, manufacture and uses.
- (iii) Soft and hard solders, spelters and flux, composition and use.
- (iv) Lubricants and simple metal finishes.
- (v) Permanent and temporary fastenings.
- (vi) Applications of various forms of metal work in industry: casting, forging, rolling, shaping by cutting tools, hand and machine. Sheet metal work and welding.
- (vii) Elementary design.

(c) PRACTICAL

The course work should include the following operations:

- (i) Setting out, filing, drilling, soft and hard soldering and brazing, riveting, hardening and tempering, and annealing of steel and copper alloys. Screw cutting with taps, stocks and dies. Sheet metal work, including tin-plate work.
- (ii) Forge-work: Bending, twisting, drawing down, flattening, swaging and upsetting.
- (iii) Lathe Work: Centre and face plate turning, simple screw cutting, knurling and boring.
- (iv) Beaten metal work: Hollowing, raising, planishing, piercing, decoration and finish in copper, brass and other suitable alloys.

For the practical examination, candidates will be given a test involving any or all of the above operations. The test may be carried out in the school workshop or at a specified centre.

N.B. The school should retain final year course work in drawing and practical work for inspection by the examiner.

PRACTICAL ELECTRICITY

The examination will be held in three parts and the candidate will have to satisfy the examiners in each part:

- (a) Drawing (1½ hours)
- (b) Theory (1½ hours)
- (c) Practice (3 hours)

Teachers and pupils are advised that questions on paragraph 4 and succeeding paragraphs in the following syllabus for Theory will be of a qualitative and practical nature only.

(a) DRAWING

Candidates will be tested for their ability:

- (i) to read and to make elementary working drawings properly dimensioned and to scale. British Standards on Engineering Drawing Office Practice No. 308A of 1958 or later is the reference standard.
- (ii) to make dimensioned free-hand sketches of simple electrical and electronic components.
- (iii) to interpret simple electric circuit diagrams making use of conventional graphical symbols for electrical and telecommunication purposes.

(b) THEORY

(i) Tools and Materials.

The use and care of the electrician's common tools.

Safety precautions.

Common materials used in electrical work; their nature and applications.

Use of wire gauges, sheet metal gauges, and tables.

Tapping and clearance drill sizes and threads in common use.

(ii) Soldering.

Soft solders and fluxes used in electrical work.

Precautions to be used when soldering.

(iii) Direct Current Theory.

Ohm's Law and the electric circuit. The measurements of amperes and volts. Resistors, construction of. Colour coding.

Series and parallel circuits. Power and energy. Fuses. Cost of household electricity. Kirchhoff's Laws. Simple calculations associated with the above.

(iv) Alternating Current Theory.

The generation of alternating current. The concept of frequency. Determination of Peak, RMS, and Average values. Pure resistive circuits. Inductance. Inductors. Inductors in parallel (equation required but no proof). The pure reactance circuit. The series resistance-reactance (impedance) circuit. Power and Power Factor. Capacitance. Dielectrics. Permittivity. Capacitors. Construction of Capacitors. Capacitors in series and in parallel. The series resistance-capacitance-inductance circuit. The parallel inductance-capacitance circuit. Power measurement in alternating current circuits.

(v) Magnetism and Electromagnetic induction.

The magnetic field. The electro-magnet. Magnetization of iron and steel. Permeability.

The principle of electromagnetic induction. Lenz's and Faraday's Laws. Self-induction.

Transformer action. Magnitude of induced secondary voltages. Relationship between voltages and turns in transformers. Ratio of transformation. Practical arrangement of cores and windings. Practical applications of transformers. Autotransformers.

(vi) Electrical Measuring Instruments.

Uses of measuring instruments: Moving iron instruments, Rectifying instruments, Moving coil instruments. Instrument damping. AC and DC Voltmeters and Ammeters. Multi-range instruments. Ohm-meters. The Wheatstone Bridge. High resistance measurements (Voltmeter method). Wattmeters. Watt-hour meters.

(vii) Generators and Motors.

Principle of generator action. The commutation process. Frequency of alternating current generators. Field excitation. Alternating current generator action and operation. Direct current motor principle. Types of direct current motors. Starting a direct current motor. Alternating current motors: single-phase types. The universal motor. The induction motor principle. The shaded-pole motor. The split-phase motor.

(viii) Introduction to electronics.

Electron tubes. Classification of tubes. Thermionic emission. Diode valves. Diode rectifier circuits. Triode valves. How a triode amplifies the control grid voltage. Basic amplifier circuits.

Simple concept of semi-conductors. The germanium diode. The junction transistor. Simple operation of a transistor as an amplifier. Precautions to be taken in using test meters and soldering irons in transistor circuits. The block schematic diagram of the straight and superheterodyne receiver with a simple explanation of the differences between the two; i.e. (i) the meaning of amplification, (ii) the meaning of detection, (iii) the purpose of a valve oscillator.

The frequencies present in the various stages of the receiver.

(c) PRACTICAL

The aim of the practical classes should be twofold: to familiarize the candidate with the practical aspects of the above-mentioned theoretical notions and to provide at the same time an elementary knowledge of basic manufacturing processes. These requirements will be met by the construction of useful electrical components required for electrical experiments such as: knife switch, electric bell, model telephone transmitter and receiver, model motors, small transformer, induction coil, power pack, simple circuits used in radio (crystal receiver, one valve amplifier).

The course should therefore include the following operations:

- (i) Soldering practice in all typical joints used in electrical and electronic circuits including screened conductors and miniature components.
- (ii) Simple bench work.
Filing, drilling, riveting, sheet metal work, screw cutting.
- (iii) Electrical work.
Preparation of laminated magnetic cores. Winding of solenoids and coils. Construction of resistors and shunts.
- (iv) Electrical measurements.
Practice and use of simple testing gear: voltmeter, ammeter, ohm-meter, wattmeter, multimeter, insulation tester, and the Wheatstone Bridge.

For the practical examination, candidates will be given a test involving any or all of the above operations. The test may be carried out in the school workshop or at a specified centre.

N.B. The school should retain final year course work in drawing and practical work for inspection by the examiner.

TECHNICAL DRAWING

The examination will be in two parts.

(a) Geometrical Drawing (2½ hours)

(b) Machine Drawing (2½ hours)

(a) GEOMETRICAL DRAWING

Plane Geometry.

Construction of plain and diagonal scales, triangles, quadrilaterals and polygons. Problems on circles, tangents and on areas of plane figures. Simple problems on loci, including paths of points in elementary linkwork.

Solid Geometry.

Elementary projections of points, lines, planes, inclined surfaces, and solids, including the cylinder, cone and sphere. Simple sections. Projection of additional plans and elevations.

Isometric or oblique projection of simple plane surfaces and solids. Development of surfaces.

Simple interpenetration of solids.

(b) MACHINE DRAWING

The making of scale drawings of machine or engine parts, including sections and new views: knowledge of parts such as nuts, bolts, studs and crews, simple castings, shaft bearings and couplings.

The drawings are to be prepared from given details of their component parts, or from drawings of the assembled machine or engine parts.

Freehand sketching of hand or machine tool or engine parts: sketches are to be made in good proportion using plans and elevations or isometric projection. The recommendations of the British Standards' Institution on Engineering Drawing Practice B.S. 308A: 1958 or later must be followed for the preparation and dimensioning of drawings.

DRESSMAKING

The examination will consist of three sections and candidates must satisfy the examiner in each section.

(a) THEORY PAPER (1½ hours)

(b) DESIGN AND DRAFTING (1½ hours)

At this examination candidates will be required to design and draft a pattern for a garment, and choose and order suitable material for making up the garment.

(c) PRACTICAL TEST (3 hours)

At the examination candidates will be required to:

- (i) carry out as much as possible of the work planned at the design and drafting session.
- (ii) show a selection of work completed during the previous two years. This should include:
 - a. an undergarment.
 - b. shorts or a skirt.
 - c. a blouse with set in sleeves.
 - d. a simple dress (European or Chinese style).
 - e. a child's garment.
 - f. a hand knitted garment.

N.B. The examiner may also wish to see course notebooks and specimens of processes, which are included in the syllabus, but not shown on the above garments.

Syllabus:

1. Equipment.

Choice and care of equipment.

Correct use of tools.

Use, care and cleaning of the sewing machine, including some machine attachments.

2. Materials.

Elementary facts about the construction of materials—cotton, linen, silk, wool and synthetic yarns.

Selvedge and weft threads.

Choice of materials, and suitability with regard to type of garment and climatic conditions.

3. Pattern drafting.

Accuracy in taking measurements.

Foundation pattern drafting and adaptation for simple garments.

Drafting pattern for young children and babies.

Choice of styles appropriate for the individual.

Appreciation of colour and line.

4. Basic stitches used in dressmaking.

Tacking; running; backstitch; hemming; slip hemming; over-sewing; herringboning; loop stitch; buttonhole stitch; simple embroidery stitches, e.g. chain stitch and stem stitch.

5. Processes used in dressmaking.

Seams—open or simple seam; French seam; run and fell seam; overlaid seam.

Neatening raw edges—loop stitching over raw edges and single turns.

Hems—plain hems; single fold hems with binding or herring boning; false hems.

Use of crossway material—cutting and joining crossway strips; crossway material for binding and facings; use of commercial bias binding.

Straight and shaped facings.

Simple decorative edgings, e.g. shell hemming; scalloping; piping; hemstitching; pin stitch; attachment of lace.

Openings—continuous wrap; faced opening; panel opening; box pleat opening; simple side opening for skirt or shorts; side opening for a dress; insertion of zip fasteners.

Fastenings—sewing on buttons, press fasteners, hook and eyes, and tapes; worked loops; worked buttonholes; bound buttonholes; Chinese buttons and buttonholes.

6. Construction of garments.

Neck finishes—round and square necks; Peter Pan and tailored collars; Chinese collars.

Setting in sleeves.

Cuffs for long and short sleeves.

Setting fullness into bands and yokes.

Turning up hems on dresses and skirts.

Pockets.

PRINCIPLES OF ACCOUNTS

There will be one paper of 3 hours.

Candidates will be examined in the elementary principles of accounting and the ability to record transactions by double entry book-keeping: they will be expected to understand the significance of the accounts they prepare. The arrangement of the items of the syllabus is not intended to show the order in which they should be taught.

The importance of accounts as records of transactions and as an aid to the efficient management of a business or a non-trading organisation.

Recording of transactions; books of original entry, sources of information, use of documents or copies as books of original entry; analysis columns; the cash book, petty cash book, records of bank transactions, reconciliation of bank balance; the ledger, classes of ledger account, posting to the ledger, balancing and closing accounts, modern forms of ledger accounts, divisions of the ledger, control accounts, interpretation of ledger accounts; the trial balance, its uses and limitations.

Distinction between capital and revenue, income and expenditure accounts, trading and profit and loss accounts, ascertainment of profit or loss from the records, the understanding of profit or loss as increase or decrease in the net value of assets.

Gross profit; net profit; valuation of stock on hand; relation of turnover to gross and net profit; fixed and variable expenses and their relation to turnover; relation of net profit to capital invested; interest on capital; proprietors' salaries. Computations of profit or loss from incomplete records.

The trading period; treatment of charges paid in advance or in arrear; provisions for bad debts, depreciation and other losses; treatment of income accrued but unpaid.

Special forms of final accounts; manufacturing accounts, departmental accounts.

Partnerships; simple problems on the disposal of profits or losses and entries necessary on admission of a new partner.

The balance sheet, its nature and purpose. Arrangement of items to show value of fixed assets and net value of floating assets. Capital owned, capital employed, short and long term liabilities.

Joint stock companies. Simple treatment to include capital, nominal, called-up, paid-up capital, preference, ordinary, deferred; loan capital; debentures, simple and mortgage; fixed and floating charges; appropriation of profits. Simple cases of final accounts of a limited liability company with the usual adjustments, but matters, such as taxation, forfeiture and re-issue of shares and company reconstruction are excluded.

TYPEWRITING AND SHORTHAND

(i) Typewriting

The Typewriting Examination consists of 2 parts:—Part I & Part II.

The Typewriting Examination is intended to be a test of accuracy, neatness, intelligent display and reasonable output.

Part I: Speed & Accuracy Test. (10 minutes)

This is a test of a candidate's general ability in the skill of typewriting as well as speed AND accuracy.

Candidates will be expected to continue typing at a speed of not less than 20 words per minute throughout the ten minutes. No erasers may be used for this part of the examination.

(All Typewriting candidates will be given 10 minutes' straight-forward copying practice *before* the actual examination commences. This will NOT form part of the examination; the matter required for this practice will be provided by the Examiners).

Part II: Typing from Manuscript and/or Corrected Typescript & Typewriting Display. (1 hour 50 minutes)

Candidates should be familiar with all aspects of typewriting practice, including correspondence, invoices, balance sheets, statements of account, tabulated lists, etc. The examination will demand the ability to copy commercial letters, other matter and tabular statements from typed and manuscript copy and corrected type-script. A knowledge of printers' correction signs is required, also a knowledge of well-known commercial and general abbreviations.

Erasers MAY be used in Part II of the examination, but all erasures must be neatly executed. A good standard of work is required of the candidate and great attention must be paid to accuracy, display and English.

Candidates must make their own arrangements for the provision of typewriters.

(ii) Shorthand. (ONE Paper) (1 hour)

Writing in shorthand from the dictation of a passage at 60 words per minute, for a period of 5 minutes and transcription therefrom.

The passage selected will be either of a commercial, technical, or general nature. Descriptive passages may be included.

Punctuation and Paragraphing will not be dictated.

Any well-known system of shorthand may be used. Candidates should possess a ready knowledge of the principles of whatever system they use, and of their application. They should have practised the taking of notes at the required speed and the transcription of such notes. Special attention must be given to spelling and punctuation.

The transcript must be written in INK. Shorthand notes may be taken in ink or pencil.

Preliminary Practice: There should be a Preliminary Practice, consisting of one selected 5-minute passages at a speed of 60 words per minute. This passage is NOT for transcription. The sole purpose of this is to get the candidates accustomed to the reader's voice and manner of dictation.

ELEMENTARY CHINESE

The examination will consist of one paper (2 hours).

The paper will consist of:

- (1) One passage of Chinese prose for translation into English.
- (2) One passage of English prose for translation into Chinese.
- (3) A short essay, a simple letter or a prose description of a subject selected from a number set for choice.

Candidates may write in the literary style or in Kuo Yu as they choose.

Recommended reading for candidates: at least one of the books listed below:

(1) 背影	朱自清	(6) 火災	葉紹鈞
(2) 紿青年十二封信	朱光潛	(7) 落葉	徐志摩
(3) 空山靈雨	許地山	(8) 趕集	老舍
(4) 雷雨	曹禺	(9) 邊城	沈從文
(5) 阿Q正傳	魯迅	(10) 縱網勞蛛	許地山

APPENDIX

(FOR INTRODUCTION IN 1969)

MATHEMATICS

SYLLABUS B

GENERAL

1. There will be two papers of 2 hours each.
2. The aim of the examination is to test ability to understand and to apply mathematical concepts rather than to test ability to perform lengthy manipulations.
3. The syllabus sets out only the final achievements expected of a candidate on completion of a five-year secondary course, and for teaching purposes some items may have to be dealt with repeatedly with different approaches at different stages before reaching the requirements of the syllabus. The order of the various topics in the syllabus does not suggest the sequence in which they should be taught.
4. Candidates will be expected to do some deductive thinking and to do some simple proofs. Credit will be given to a clear and systematic presentation of an argument. Symbolic expressions are often helpful in making statements concise and precise, and candidates will be expected to be familiar with the use of approved symbols which are listed in the syllabus. However, a strict axiomatic treatment of the topics will not be required; and some sections, where specified, will be treated entirely by intuitive methods.
5. Slide Rules, flexible and French curves may be brought into the examination. Four-figure mathematical tables will be provided.

EXAMINATION SYLLABUS

Knowledge of Primary School Mathematics is assumed.

Rough estimates, approximations, significant figures and limits of accuracy.

Primes and factorisation of natural numbers. Principles of simple divisibility tests for 2, 3, 4, 5, 8, 9, 11. L.C.M. and H.C.F. including the general principles of finding the H.C.F. (Euclidean algorithm).

Simple statements, the negation of a statement (\sim), compound statements using connectives "and" (\wedge), "or" (\vee), "if . . . then" (\Rightarrow), "if and only if" (\Leftrightarrow). Truth values and truth tables. The use of the above in presenting arguments. (The emphasis will be on the understanding and presentation of logical arguments rather than on formal manipulations).

Principle of mathematical induction.

Sets, member (or element) of a set, subset, union, intersection, difference, complement, universal set and empty set. Venn diagrams and their use in illustrating set operations and in solving problems. (Approved symbols: $\{ \dots \}$, $\{ : \}$, \in , \notin , \subset , \subsetneq , \cup , \cap , $-$, $'$, ϕ). The use of composition laws for sets including $A \cup A = A$, $A \cap A = A$, $(A \cup B)' = A' \cap B'$ and $(A \cap B)' = A' \cup B'$ (formal proofs will not be required). Ordered pairs, simple ideas of mappings (or functions).

Representation of integers by means of different bases, including base 2, (The number a to base b will be expressed as a_b with b always in denary). Simple flow charts.

Informal discussion of integers, rational numbers, the real number system and the complex number system. (The concept of ordered pairs applied to the above where appropriate).

Binary operations. Informal discussion of associativity, commutativity, distributivity, neutral element and inverse. Modulo arithmetic treated intuitively. The elementary idea of a group and its sub-groups as illustrated by examples such as modulo arithmetic, integers and addition, non-zero rational numbers and multiplication, rotation and reflection of triangles, quadrilaterals and regular n-sided polygons, matrices and matrix-multiplication.

$m \times n$ matrices with $1 \leq m, n \leq 3$, and operations on them: addition, multiplication and scalar-multiplication. System of m linear equations in n unknowns with $1 \leq m, n \leq 3$. Square matrices and determinants of order ≤ 3 . Unit matrices, non-singular matrices and simple numerical cases of their inverses. Vectors and simple applications in geometry.

Knowledge of the following will be assumed but no formal proofs of any kind will be required: Parallel lines and their tests. Angle sums of triangles and polygons, base angles of an isosceles triangle, equiangular triangles have their corresponding sides proportional, Pythagoras' relation, angle in the alternate segment, angles in the same segment, angles in a cyclic quadrilateral. Lengths, areas and volumes; mensuration of common plane and solid figures, including polygons, polyhedra, circle, cylinder, cone and sphere. Plans and maps, areas and volumes of similar figures.

Simple transformations of the plane; reflection, rotation and translation, combination of the above transformations; identity and inverse transformation. The transformations connecting directly or oppositely congruent figures. The ideas of shearing and stretching. Transformations in terms of co-ordinates: reflection in the lines $x = 0$, $y = 0$, $x = \pm y$; rotation through multiples of 90° . Expression, by 2×2 matrices, of reflection, rotation, enlargement and shearing.

Symmetry about a point, a line and a plane.

Informal discussion of simple networks: odd nodes, even nodes, unicursal (one-stroke) network, matrix description of a network.

Three-dimensional figures: angle between a straight line and a plane and between two planes, nets of solids, Euler's relation for convex polyhedra. Plans and elevations (ability to produce technically correct figures will not be required).

Polynomials in one variable and their fundamental operations (questions will not be set on lengthy multiplication and division). Simple algebraic fractions. Factorisation of $ax + bx$, $a^2 - b^2$, $a^2 \pm 2ab + b^2$. Easy identities, easy equations including the general quadratic equation.

Functional relations and graphs. Simple curves including the curve $y = e^x$. Gradients of curves by drawing, estimation of area under curves by square counting or trapezium rule. The idea of rate of change.

Laws of indices. Slide rule.

Rectangular Cartesian co-ordinates in 2 and 3-dimensional spaces. Equations of lines in 2-dimensional space and planes in 3-dimensional space. Simple loci in 2 and 3-dimensional spaces.

Measurement of angles (degrees and radians). The functions sine, cosine, tangent and their graphs. The relations $\tan A = \sin A / \cos A$, $\sin^2 A + \cos^2 A = 1$. Solution of triangles in cases reducible to right-angled triangles. Simple 3-dimensional problems. Courses and bearings. Latitude, longitude, great and small circles, nautical miles, distances along parallels of latitudes and along meridians.

Simple probability theory including application of the sum and product laws.

Collection and organisation of numerical data, and their graphical representation by bar chart, pie chart, frequency polygon and cumulative frequency polygon, histogram. Calculation of the mean. Estimation of the median and quartiles, inter-quartile range.