

1995 HIGHER SCHOOL CERTIFICATE EXAMINATION

GEOLOGY

291 candidates presented for the examination in Geology at the 1995 Higher School Certificate Examination. This was a decrease from the candidature in 1994.

The quality of the candidature was similar to that of previous years, and responses from the top students continued to be outstanding. Many students, however, attempt to answer electives that they have not studied. Such candidates scored very poorly.

It was again evident that many students fail to read questions carefully or to use all stimulus material provided. Many questions require the application of knowledge and skills rather than repeating information learnt by rote. Geological problem-solving needs to be integrated into all parts of the course and especially the Core and Electives E1, E2 and E3.

The drawing of carefully labelled diagrams where necessary needs more attention and practice.

Electives require responses based on a greater depth of information than is required in similar areas addressed in the Core.

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SECTION I : CORE

Part A : Multiple Choice

The table below gives the percentages of the candidature selecting each option in the multiple choice questions. The correct answer is marked with an asterisk(*).

Question	A	B	C	D	% Correct
1	36.24	25.78	30.66*	7.32	30.66
2	12.20	79.79*	2.09	5.92	79.79
3	19.16	29.97	14.98	35.89*	35.89
4	2.79	2.79	86.76*	7.67	86.76
5	61.67*	2.79	10.45	25.09	61.67
6	33.80*	35.54	22.30	8.36	33.80
7	20.21	7.32	64.11*	7.67	64.11
8	28.57	15.68	2.79	52.96*	52.96
9	17.77	72.13*	4.88	5.23	72.13
10	89.20*	5.57	3.48	1.74	89.20
11	11.50	72.13*	5.23	11.15	72.13
12	4.18	42.86*	51.92	1.05	42.86
13	5.57	3.48	36.59	54.36*	54.36
14	38.33	18.12	17.77	25.78*	25.78
15	2.44	4.53	68.64*	24.39	68.64

Part B

Question 16

- (a) Most students failed to recognise the difference between structural and stratigraphic oil traps.
- (b) A number could describe only one characteristic, i.e. impervious or impermeable, and incorrectly used the term *non-porous* as being a cap rock characteristic.

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Question 17

This was a broad question and, as a result, there was an extremely broad range of answers. Many students failed to realise that mines need to be rehabilitated as a result of leaving a *hole* and scar in the landscape.

Question 18

Generally responses indicated a poor understanding of the internal structure and processes occurring below a mid-oceanic ridge.

- (a) Students had difficulty in naming an igneous rock from layer X. Many used ultra-mafic rocks such as peridotite rather than gabbro.
- (b) Responses were varied since many students failed to appreciate the scale and included sands from the continents.
- (c) A number of students recognised the part played in the spreading of the sea floor; a significant number, however, incorrectly said that sediment rolled down the ridge to settle on the flanks.

Question 19

This question was generally well answered. The majority of students followed the wording of the question by identifying the relevant factors and indicating their effect on the opening and/or closing of the mine. Some responses, however, were too general.

Question 20

- (a) Most students understood the concepts involved in the formation of linear volcanic chains. Some had difficulty in describing whether the plate or hot spot had moved.
- (b) This part was, on the whole, well answered.

Question 21

- (a) Most students successfully named a rock typically found in the fold mountains distributed around the margins of the Pacific Ocean.
- (b) There were many detailed descriptions of the mineralogical composition of the candidates' chosen rock.

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- (c) Whilst the majority of students could state how their chosen rock formed, many failed to express its formation in the context of the formation of the mountains.

Question 22

Students did not understand the scale of the map. They had difficulty in placing the volcano on the overriding plate and the size of features was often too large. Many did not provide sufficient labels in attempting to describe the geological features.

Question 23

- (a) This part was well answered.
- (b) In measuring the fault displacement, many students did not select correct boundaries to determine the distance displaced.
- (c) This part was well answered.

Question 24

- (a) Most students correctly identified the area as a shield.
- (b) Many responses here were incomplete. Whilst students recognised the part played by a long period of orogenesis and metamorphism, they failed to highlight the isostatic response of deep-seated crust rising towards the surface as uplifted portions were eroded.

Question 25

- (a) This part was reasonably well answered. Most students realised that granite samples could be collected at both sites and then analysed to ascertain their mineralogical composition and radiometric age by using the Potassium-40/Argon-40 method of dating.
- (b) This part was poorly answered. Students failed to realise that the radiometric age of the granite at both sites could have provided different ages because of diffusion of argon gas from crystals in the granite at one site after separation of the continents occurred.

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Part C

Question 26

- (a) This part was not well answered. Responses were incomplete and students failed to describe logically the sequence of events from minerals being magnetised to the process of sea floor spreading, producing mirror images of the magnetic anomaly pattern on both sides of the ridge axis.
- (b)
 - (i) This part was also poorly answered. Students found difficulty in correlating the magnetic anomaly pattern with the magnetic polarity time-scale.
 - (ii) Most students failed to recognise that the rate of spreading incorporates what occurs on both sides of the ridge.

Question 27

- (a) This part was well answered. Most students who did not choose the correct outcrop, Z, chose outcrop Y which was the next best response.
- (b) There were some excellent detailed responses, but most were incomplete, giving insufficient detail. Many students failed to recognise that cassiterite might have formed as a primary hydrothermal or pegmatitic deposit in an igneous intrusion.
- (c) This part was well answered.

Question 28

Most candidates answered this question well. They were able to match volcano shape correctly to style of eruption and internal structure.

Question 29

- (a) This part was well answered.
- (b) Since this was poorly answered, very few students scored full marks for this part. Many referred to the slope's causing some form of mass movement; this often contradicted their answer in part (a).

Some students misunderstood the fact that clay expansion was due to heat not water. Many inappropriate comments were made, stating that the foundations were built on loose clay or weak shale.

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Question 30

- (a) This part was generally well answered, but some students described sea-flour spreading instead of land-based evidence.

Many provided inadequate detail, especially when describing fossil evidence. Simply stating *similar fossils* is inadequate.

- (b) Some students showed a complete lack of understanding of isostasy. Most, however, had some concept of the balance of the lithosphere and asthenosphere. The better candidates related vertical movement (isostatic readjustment) to lateral movement on a mobile plastic substrate.

Question 31

Many students, despite three references to *the aerial photograph*, treated the photograph as a cross-section. It appeared that many students have not been exposed to aerial photographic interpretation.

- (a) (i) Detailed sketching of a large scale geological feature was poor. Most candidates drew the structure as a recumbent fold which is not shown in the aerial photograph.
- (ii) This part was also very poorly answered. Most of the students failed to answer what was asked, i.e. *how* the structure is evident in the aerial photograph. Some of the better answers referred to shadows, patterns of light and dark strata, vegetation, and different patterns and degrees of weathering and erosion.
- (b) This part was very well answered. The majority of students were able to describe a modern orogenic belt adjacent to an active subduction zone.

SECTION II : ELECTIVES

Question 32 : Contemporary Sedimentary Processes

- (a) (ii) 1. Many students named only **one** sediment type.
2. The majority showed only the main current flow; in the case of a river, this was in the main channel and ignored any movement from tributaries or sheet flow from the sides of channels.
3. This part was well answered.

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- (b) (i) Most students could describe the source of the sediments in a specific environment; outlining a scientific investigation carried out to determine the source proved difficult in many cases.
- (ii) Supporting evidence to describe the energy characteristics of the transporting agents was poor and tended to consist of rote learnt statements only.
- (c) Many students were not familiar with the experimental methods used to determine the properties of the sediments. Consequently, composition of sediments was frequently ignored.
- (d) The majority of students could adequately treat only one sedimentary structure.
- (e) This part was well answered.
- (f) This part was very poorly answered. It was obvious that few students had examined outcrops of sedimentary rocks in the field.

Question 33 : Igneous Rocks

- (a) (i) Many students described in some detail, rather than named, the texture of rock A. The better students successfully gave the name of the texture type.
- (ii) This question was generally well answered. Students either knew the answer or did not; generally they did know it.
- (iii) Students too often just simplified the relationship between fast cooling and fine grains, and slow cooling and coarse grains. Frequently they failed to explain the condition that resulted in these different cooling rates.
- (iv) A majority of the answers were either correct, i.e. *Gabbro*, some candidates incorrectly stated *Granite*.
- (v) Some students described volcanoes or eruptive styles rather than one tectonic setting as required.
- (b) (i) Most students gave the correct tectonic setting of the M.O.R or hotspot. The better students gave *partial melting*, others just stated *melting* of the asthenosphere or peridotite or Upper Mantle. Few students described mineralogy, source of heat, convection currents, etc.

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- (ii) Once again most pupils gave the correct tectonic setting of a subduction zone or destructive plate margin. Many answered partial melting of the subducted plate.

This section of the question (describing the process) was answered better than part (i).

Some students described the subductive process for both basalt and andesite.

A number of candidates also explained both sections (i) and (ii) with the aid of cross-sectional diagrams, which were well labelled.

- (c) This part was very well answered by most students, although some were unable to give a specific locality, rather than a general plate-tectonic setting.
- (d) This part was well answered on the whole, although there does appear to be some confusion amongst students in relation to the proportion of volatiles to viscosity where there was a misconception that more viscous lavas necessarily have a higher volatile component. This is incorrect.
- (e) Candidates, on the whole, appeared to understand the concepts of magmatic differentiation. This appears, however, to be generally an area in which candidates need to develop a deeper understanding of the range of processes leading to ore formation.
- (f) This part of the question was well answered by some candidates, but others showed little appreciation of the chemistry of common rock-forming minerals.
- (i) This part was generally well answered, although some candidates attempted to pick a rock (X, Y or Z) which fitted all four criteria rather than choosing one rock for each criterion.
- (ii) Some candidates did not appreciate the relationship between the terms *felsic (acid) intermediate, mafic (basic), ultramafic with silica content*.
- (iii) Almost all candidates correctly nominated a felsic plutonic or volcanic rock, but many could not give an acceptable reason for their choice.

Question 34 : Economic Geology

- (a) (i) Answers here lacked geological description. Most students referred only to economic aspects.

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- (ii) This part was generally well answered, although there was some confusion about the meaning of *grade* and *tonnage*.
- (b) 2. Students generally knew the useful components of the resource, although some were confused about metals/minerals/lodes/ore, saying, for example, "the metals in the ore are chalcopyrite and sphalerite". Some descriptions of the resource's eventual use were too general. *Use as an export* is not a satisfactory answer, neither is *use in the building industry*; a more specific answer is required, e.g. iron is used to produce steel for reinforcing in concrete structures.
3. Geological sections lacked detail. There is a need to label any geological structures, lithological variations, orientation of section, keys were sometimes omitted, while scales were only vertical or horizontal.
4. Detail was lacking in many answers. For a detailed description all stages in the formation should be included and written in the correct sequence. Students studying non-metallic resources, e.g. limestone deposits, tended to write very brief answers. They were expected to include detail on the origin and formation of the limestone as well as the source of the calcite, the lithification processes and any structural developments, including the stages involved in the change from the environment of its formation to its present environment.
5. Extraction refining methods were adequately covered, but there was indication of rote learning rather than understanding of the sequence of events and the processes involved. As a result, students lost marks as stages were out of sequence and the method was inappropriate for the materials being considered. Properties of the ore or economic resource need to be related to the process. Quality variation was poorly handled and few students could describe the problems related to quality variation.
- (b) 1. Some new projects had been studied and there were some good answers.
2. This was generally well done.
3. Detail was lacking in the answers to this part.
4. Students described geological features quite well but needed to relate them to design and construction.
5. Although there were some good answers, most were descriptive and lacked explanation.

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- (c) (ii) This was poorly done. Students appeared to have little practical appreciation of the exploration methods involved.
- (iii) Most students could list the exploration methods they considered most effective, but many had difficulty in indicating the reason(s) for their effectiveness.
- (iv) Students indicated a high level of understanding and appreciation of environmental issues associated with their chosen mine or project.

Question 35 : Regional Geology

On the whole many students did not give sufficient detail to indicate the depth to which they had studied this elective. While the format of some questions did not lead to detailed answers, those which did so were generally not answered in sufficient detail.

- (a) Many students were unable to give more than a superficial use of the techniques listed; this might have indicated that limited investigatory techniques were used in their study.
- (b) (ii) Most students gave correct stratigraphic order in the correct geological period.
- (iii) Although some questions were well answered, few students could answer each of the questions for their named rock unit.
- (c) This question was generally very poorly answered, indicating little knowledge of the adjoining region.
- (d) and (e) These parts were both well answered.

Question 36 : Palaeontology

- (a) (i) These parts were generally well answered. Candidates showed a sound and knowledge of major morphological changes and their relationships to the environment.
- (ii) environment.
- (iii) This was not as well answered in spite of the wide coverage that *catastrophe* theories have received in the popular media. Candidates appeared to possess a superficial knowledge of the nature of possible causes, but were vague about the environmental consequences.

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- (b) This part was generally not well answered. Few candidates appeared to possess a working knowledge of the principles involved in the classification and species determination of fossil specimens. Their knowledge of problems, however, was slightly better.
- (c) This part was generally well answered, with students displaying a sound knowledge of the reasons for the lack of terrestrial fossils.
- (d) This part was generally not well answered.
 - (ii) Responses to this part generally referred to valid field-trips, but the quality of the answers rarely exceeded Preliminary Course standards.
 - (iii) Responses here showed a knowledge of distinctive features of the organisms, but did not relate them well to stages in human evolutionary development.