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Geology

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1997 HIGHER SCHOOL CERTIFICATE
EXAMINATION REPORT
GEOLOGY

235 students presented for the 1997 Higher School Certificate Geology Examination. This was a small decrease on the candidature of 1996.

The standard of the candidature and the quality of responses were very wide ranging and responses from the top students continued to be outstanding. Many of the weaker students showed knowledge of factual information but an inability both to interpret the questions set and to apply their knowledge to skills–based questions. Students need to pay attention particularly to the wording of the questions and to the significance of words shown in italics or upper case.

Answers to many questions lacked depth, even when the question indicated that detail was required. Students need to consider carefully the meaning of the directive term used in the question, eg *explain, describe, state* etc. One or two words rarely provide a good answer to a question asking for a description and are certainly insufficient when a detailed description is required.

The standard of drawing was, generally, either very good or extremely poor. Students need to think carefully about the most appropriate type of diagram, eg, plan view, cross section or block diagram, to illustrate a specific situation. For example, in Question 30, those who drew plan views found it impossible to label effectively all the features specified in the question. When labelling diagrams, students need to indicate clearly by using arrows, shading etc, the feature to which the label refers.

Elective responses varied considerably. On the whole, however, responses still indicate that many students fail to realise that greater depth of information is required than in the Core. This is particularly obvious in those parts of electives where there is considerable overlap with the Core, such as sections of Igneous Rocks.

Section I Core

Part A Multiple Choice

The table below gives the percentages of the candidature selecting each response. Examination of these statistics indicates that most students performed well in this section of the paper. Correct answers are marked with an asterisk.

Question	A	B	C	D	% Correct
1	7.83	83.04*	5.65	3.48	83.04
2	80.87*	7.83	2.17	9.13	80.87
3	8.26	2.17	4.35	84.78*	84.78
4	0.87	4.78	90.87*	3.48	90.87
5	10.43	20.43	67.83*	1.30	67.83
6	17.39	76.09*	3.04	3.04	76.09
7	64.35*	10.43	13.91	11.30	64.35
8	5.22	30.00	59.13*	5.65	59.13
9	7.83	10.00	20.00	62.17*	62.17
10	2.61	91.30*	2.61	3.48	91.30
11	16.52	50.87*	13.48	18.26	50.87
12	19.13	35.65*	9.13	35.65*	35.65
13	50.00	7.83	17.39	24.78*	24.78
14	7.83	17.83	69.13*	5.22	69.13
15	90.00*	3.48	4.35	2.17	90.00

Part B

Question 16

The better candidates had little difficulty in scoring full marks for this question.

(a) This part was well done by most students.

(b) Many candidates described a location where *lava* was extruded, saying, for example, *at a hot spot*, rather than giving the source of the *magma.*

(c) This was generally answered well.

Question 17

Responses to this question were disappointing. Many students, instead of *describing* how the mining company should *examine* and *document* a site, merely *listed* factors that should be considered to aid in its rehabilitation.

Question 18

(a) Most students gave adequate responses to this question.

(b) In the better answers candidates gave specific advantages such as the fact that *geothermal power does not release gases into the atmosphere in the way fossil fuels do*. Many answers, however, were too general, stating for example, *geothermal is more environmentally friendly*.

(c) Quite a few candidates misinterpreted the question, focussing on risks to the energy supply rather than to geothermal power stations themselves.

Question 19

(a) Whilst most students appeared to know the relationship between anomalies on either side of the ridge, many needed to be more accurate in the plotting of data.

(b) Of those who attempted this question, too many divided time by distance, despite the fact that they were asked to express their answers in centimetres per year.

(c) This was poorly answered, with many students showing a lack of understanding of the processes operating at mid–ocean ridges.

Question 20

(a) This part was well answered by most students.

(b) The majority of students gave a range of sizes rather than the average grain size of the ash that fell on Pompeii.

(c) Answers here were good, on the whole; some candidates, however, used *ash falls* as an answer, despite the fact that the question said *apart from ash fall*.

Question 21

(a) This question was generally well done, although some students listed only the hazards and did not relate them to the daily operation of the mine.

(b) Answers here were very good.

Question 22

(a) Diagrams were often inadequately or inaccurately labelled. Students should realise that it is more appropriate to show mountain formation in cross–section than in plan view.

(b) This was well answered, with most students successfully stating a reason for the apparent contradiction. Attempts to explain the process involved (although not required by the question), often indicated, however, that students are very confused about these processes.

Question 23

This question was answered either very well or poorly by most students.

(a) About half the students recognised the zone *X* as being the asthenosphere or the *LVZ.* A few students misinterpreted the question and/or diagram and named a boundary instead of a zone.

(b) Those who correctly identified zone *X* generally answered this part well. Students do need to be more specific, however, when using comparative terms, eg *more dense*. (More dense than what?)

(c) This part was not well answered. A large number of students failed to consider the role of the asthenosphere and merely wrote some ideas about isostasy. Use of specific terms such as *lithospheric plates, mobility* and *equilibrium* would improve answers.

Question 24

(a) A majority of students correctly identified Core 3, but many failed to justify their choice by using sediment thickness compared with time.

(b) Many students provided rough ages for the sediments in Core 3 ranging from 1.5 to 2 million years when greater precision was possible from the diagrams. A common incorrect response was an age of 3.5 million years, derived, presumably, by drawing a horizontal line between the core and the time–scale.

(c) Answers here were very poor. *Using fossils* was the most common answer but this lacked the *detail* required by the question.

Question 25

(a) Most students answered this part well, but care needs to be taken when drawing arrows and lines to ensure that the location is clear.

(b) Answers here were poor. Reasons given were vague and not supported by evidence from the diagram.

Part C

Question 26

(a) Answers here were generally good. Students seemed to understand the concept of *remanent magnetism* but should also be aware that not all iron–bearing minerals are magnetic.

(b) Most students answered this part well.

(c) Answers here were poor. Candidates had little idea of why the potassium–argon method would be suitable for dating this sample of basalt.

Question 27

(a) Most students recognised *cassiterite* as being the most profitable but did not take into account the *basic infrastructure costs* as well as the *additional costs* when calculating the final profit after extracting the ore.

(b)
and These parts were well answered, but some students had difficulty in distinguishing between
(c) *infrastructure* and *additional costs*.

(d) Answers here were good.

Question 28

(a) Candidates did not answer this part well, the most common mistakes being placing *A* at *2* and *C* at *5*.

(b) Many students failed to mention partial melting, but the ideas on subduction, heat and friction as shown in the diagrams were generally well conveyed.

(c) Here some students drew a *fold* instead of a *fault*. Many diagrams were poorly labelled and did not indicate relative movement.

(d) Most students recognised rock *D* as being clastic. Some incorrectly named it *conglomerate* because they failed to use the scale provided.

(e) Those who correctly identified the processes of *erosion* and *uplift* often failed to provide the description required. A significant number of students incorrectly interpreted the *rock* at 4 as *magma* and therefore explained exposure at the surface in terms of *extrusion*.

Question 29

Most students found parts (a), (b) and (c) of this question difficult; it would appear that few had specifically studied porphyry copper deposits. Some, however, adequately answered the questions by interpreting information used in the diagram.

(a) Candidates had little knowledge and understanding of how porphyry copper deposits form. The majority showed some connection with igneous processes. Magmatic differentiation was sometimes incorrectly applied.

(b) Students had difficulty in describing the process of hydrothermal alteration.

(c) Most students named one significant feature of the texture of the rock found at *A* but few described the texture in detail. Good answers involved consideration of features such as grain size (relative and absolute), shape and relationship.

(d) Many students named minerals rather than metals.

Question 30

(a) A significant number of candidates incorrectly considered the Red Sea to be a convergent boundary.

(b) Those who recognised the Red Sea as a divergent boundary usually provided satisfactory diagrams; labelling was often poor, however, particularly when students had drawn plan–view diagrams.

Question 31

(a) Most students were able to give two pieces of evidence that support the theory that Jumbuckie and Bandiland were once joined, but in the case of correlating mountain ranges, however, they failed to state that they were of the same age.

(b) Although this was generally well done, many candidates had difficulty in including an appropriate scale. Some misinterpreted the direction of plate movement and subduction.

(c) This part was well answered.

Section II Electives

The table below shows the approximate percentage of the candidature attempting each of the electives.

Question	Candidature %	Page
Question 32 — Contemporary Sedimentary Processes	20.5	7
Question 33 — Igneous Rocks	49.5	8
Question 34 — Economic Geology	27.0	9
Question 35 — Regional Geology	0.0	10
Question 36 — Palaeontology	3.0	10

Question 32 Contemporary Sedimentary Processes

This elective relies heavily on fieldwork and follow–up in the laboratory. Responses indicated that students had been actively engaged in these activities. Many, however, seemed to have difficulty in understanding and interpreting their data and expressing it in writing, tables or diagrams. A significant number correctly described procedures, but applied them to the wrong situations.

A number of students indicated lack of understanding of terms used in the question, eg *transporting medium* and their descriptive answers were very general rather than scientific. It would appear that students are not effectively utilising the related knowledge and skills learnt in the Preliminary Unit on Surface Processes.

(a) (ii) The quality of maps varied considerably. Many students did not include aspects of the map such as *scale* and *direction.* Most labelling on maps tended to be geographical rather than geological.

(iii) This part was generally well done, but a few students did not understand the term *transporting medium*.

(iv) Here most students chose *velocity* but their answers were often broad (and sometimes inaccurate) generalisations, such as *fast, high, strong*. Where numerical values were given, the units were frequently omitted, incorrect or inappropriate.

(v) The majority of students had some idea of the steps they had taken to measure the velocity of the transporting medium at site *A*. Most answers were too brief or, while including the necessary detail, inappropriate or contradictory values were used, eg for distance measured. Few realised the importance of taking several measurements.

(vi) Answers here were also very generalised and referred to velocity as being either *higher* or *lower* (sometimes without making it clear at which locality it was higher). Most students had difficulty in giving more than one reason for the differences.

(vii)
and Labelling was often poor, for example, the letter *C* placed on a river bend with no
(viii) indication as to which side of the bend suffered erosion. The explanations of why erosion was occurring were often too vague, eg, many simply wrote: *Because it is faster*.

(b) (i) Answers here were generally good.

(ii) There were very few good answers here. Only a small number of students were able to answer this question satisfactorily as they failed to understand the meaning of the word *composition*.

(iii) Again there were a few good answers, but the majority were either too general, saying, for example, *The sedimentary structures get bigger*, or merely described a few sedimentary structures without reference to the effect of changes in velocity or energy.

(c) (i) This part was very well done by most students.

(ii) Answers here were poor; as in part (b)(ii) most students did not describe the composition of the sediment.

(d) (i) Here some answers were good, but most students described major human influences without relating them to depositional patterns.

(ii), (iii), (iv)
and All students were able to name a plant and animal but some answers were very general,
(v) simply stating, *grasses, insects* etc. Students had difficulty in describing how the plant and animal named might have influenced sedimentary processes. Those who did answer the question set wrote very general answers such as *caused erosion, deposition*, etc, but rarely provided any of the description required.

(e) (i)
and Most students answered these questions well, but a significant number omitted units.
(ii)

(iii) Very few candidates answered this question correctly; only a small number used the vital information given in the stem of the question.

(f) (i)
and The majority of students named two sedimentary structures and the diagrams produced
(ii) ranged from very good to poor. As in other areas of the paper, labelling was often inadequate and scales were omitted. Again, students should consider which type of diagram should be used to best illustrate a specific feature.

(iii) Answers tended to be too brief, failing to provide the *detail* required by the question.

(iv) This question was poorly done. Students had difficulty in relating *features* to the *transporting medium*.

Question 33 Igneous Rocks

This was the most popular elective, but the standard of responses varied greatly. The better candidates clearly indicated the greater depth of study undertaken in the elective but a large number appeared to rely on Preliminary Core knowledge and skills. The majority possessed a sound knowledge of scientific terms, while their interpretive skills were very good.

The most common problem was lack of detail in written answers and inaccuracy in labelling diagrams. The greatest problems occurred in questions where there was significant overlap with the Preliminary Core. Here students tended to write answers that lacked the detail expected from an Elective study. In questions involving difficult concepts such as magmatic differentiation, however, answers were better.

(a) (i) Most students answered this question correctly, showing their understanding of tables and graphs.

(ii) Approximately half the candidates failed to recognise simple twinning in mineral *X* and, consequently, incorrectly labelled the mineral.

(iii) This part was generally answered well.

(iv) The majority of students recognised two stages or rates of cooling of rock *A*, but many failed to provide a detailed description.

(v)
and These parts were generally answered well.
(vi)

(vii) Many candidates failed to recognise the fact that mineral *S* was an inclusion; such students used terms such as *sitting on top* or *overlapping*.

(viii) Most answers here were good.

(ix) Many candidates incorrectly answered with a single number, rather than a range of total alkali content possible in a rock of the same type as rock *B*.

(x) Most students recognised the fact that rock *A* had a higher $Si0_2$ content than rock *B*. Accounts for the difference were, however, generally minimal and of poor quality.

(b) (i) Answers to this part were good.

(ii) This question was poorly answered, with a number of students failing to link water and magma with the violent eruptions. Many neither recognised nor drew high eruption columns and/or lava fountains.

(iii) Most students were confused by a basaltic volcano with violent phases; as a result a wide range of plate tectonic settings was suggested.

(iv) The majority of candidates understood the significance of a plate moving over a hot spot but few recognised the very short geological time span of 6000 years.

(c) (i) Answers here were good.

(ii) Most candidates answered this part well, identifying the basalt as comprising a chilled margin. The majority also discussed the role of the country rock in the formation of the chilled margins.

(iii) Answers to this part were not good. Few candidates wrote about late stage crystallisation, cracks and cooling, with many incorrectly providing a hydrothermal origin.

(iv) Answers here were good.

(v) This part was well answered, with responses including *early formed, high melting point, dense, gravity settling, layering* etc.

Question 34 Economic Geology

This was the second most popular elective and the standard of responses varied greatly. One of the main difficulties experienced by students was in the allocation of time. The majority provided lengthy answers which would have affected the amount of time available for the rest of the paper. Students need to pay particular attention to deciding whether a question requires a *brief outline* or a *detailed description.* Even those who did so, however, still found the elective very lengthy.

The better students possessed sound knowledge and understanding of their case studies, but many weaker ones were confused, even to the point of mixing their two case studies.

(a) (ii) This part was well answered but most students provided a detailed rather than a brief outline.

(iii) The quality of these responses varied greatly. Many did not provide a key or labelling and information on direction and scale were often missing. It was not always possible to determine whether the diagram was a sketch map or a cross–section. A number of students did not describe adequately how the choice of extraction method was influenced by the shape of the ore body and its relationship to the host material.

(iv) Answers here were good with the better students including diagrams indicating effective practical experiences during the study of the elective.

(v) This part was fairly well answered.

(b) The majority of candidates chose option (i) in this question; only a few chose option (ii).

(i) 1 Most candidates correctly named the deposit they had studied.

2 Wide variation in the style of maps produced from each centre suggested that this was not an activity covered by all students. The quality of many of the maps, however, reflected both the students' knowledge of the case study area and their ability to express this in map form.

3 Answers to this part were good.

4 This was not well answered. Many students simply discussed existing extraction/refining technology without discussing specific improvements and their effect on the exploitation of this resource.

5 (a), (b) *and* (c) These parts were generally well answered.

(ii) 2 (a) Answers here were good.

(b) Most answers to this part were brief and would have benefited from greater detail.

3 (a) Candidates answered this part well.

(b) Most students referred to only one rock rather than *each rock* and confined their answers to one characteristic rather than *characteristics*.

4 (a)
and Both these parts were well answered.
(b)

5 Most students could name an exploration method but made little attempt to *describe how* it was used in the setting–up of the project.

(c) (i) The value of copper on the world market in relation to the value of the Australian dollar was not explained well. Many students took *value* to mean *cost* and answered accordingly.

(ii)
and These parts were well answered by most students. Some, however, only described the
(iii) event instead of stating the *effect* of the event on mine viability.

(d) Answers here were very poor. The terms *indicated, inferred* and *proved* were not well understood, possibly because terminology has changed since the Syllabus was written. Few students gave two procedures that would be required to change the *inferred reserves* of a resource into *proved resources*.

Question 35 Regional Geology

No students attempted this elective.

Question 36 Palaeontology

This elective was attempted by few candidates. As in several other electives, responses were very general rather than specific. Thus they lacked the depth required in the elective.

(a) (i), (ii)
and Candidates were able to name an appropriate scientist but had difficulty in describing that
(iii) scientist's contribution to palaeontology or in explaining adequately the significance of his contribution to palaeontology.

(b) (i) This part was well answered.

(ii) 1 Answers here were also good.

2 Candidates were unable to relate the change in morphology to environment; consequently their answers were poor.

(c) Few candidates answered this question well. The majority were unable to explain the difficulties encountered in classifying fossils down to species level, when a fossil is first found at the field site.

(d) Responses ranged from very thorough to very poor; most students need to be more specific in their answers.

(e) Again, answers were too general. The number of marks allocated to the question should have given candidates some indication of the depth of treatment required in the answer.