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**Geology**

2016 Chief Assessor’s Report

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Chief Assessors’ reports give an overview of how students performed in their school and external assessments in relation to the learning requirements, assessment design criteria, and performance standards set out in the relevant subject outline. They provide information and advice regarding the assessment types, the application of the performance standards in school and external assessments, the quality of student performance, and any relevant statistical information.

## School Assessment

**Assessment Type 1: Investigations Folio**

The majority of folios presented this year showed a reasonable range of tasks. They generally provided ample opportunities for students to demonstrate learning at higher levels. It was also pleasing to note that most of the intended learning that is italicised in the subject outline was evident. Teachers are encouraged to include a checklist to help moderators find evidence of these important elements of learning.

**The more successful responses**

* provided concise descriptions of field observations using appropriate geological terms
* included scaled sketches, maps, and annotated photographs using appropriate conventions
* set an appropriate hypothesis for a planned investigation
* described in detail how possible improvements to a practical investigation could improve the quality of the results
* used a clear and appropriate focus question in an issues investigation.

**The less successful responses**

* did not appropriately acknowledge sources of information
* attached unnecessary pages of photocopied material to their work.

**General information**

* It is recommended that students submit a field notebook to allow moderators to be confident that a field investigation report is real and authentic.
* In a practical investigation design, it is preferred that students make only one hypothesis. Multiple hypotheses can be confusing and the results can be difficult for students to analyse.

Assessment Type 2: Skills and Applications Tasks

Tests were generally well designed and covered a range of specific features. Questions were carefully selected to give students opportunities to demonstrate higher-order thinking as well as recall, particularly AE1, AE2, and A1. The best tests mirrored the examination format by including typical examination questions such as multiple-choice, a graphing question, and an extended-response question. This helps students to provide a range of different kinds of evidence in their answers.

**The more successful responses**

* provided concise answers to short-answer questions and more detailed, well-expressed answers to extended-response questions.

**The less successful responses**

* wrote answers that were ambiguous or included incorrect geological terms.

**General information**

The majority of teachers included a highlighted performance standards sheet attached to most student work, showing the assessed standards. A highlighted performance standard sheet should also be used to indicate how the grade level has been determined for tests.

## External Assessment

Assessment Type 3: Examination

This year only fifteen students sat for the examination. The overall standard of answers was lower than in recent years. In some cases, the answers indicated that students had limited English-language literacy skills and were not adequately prepared for the course.

Section A: Multiple-choice Questions

This section was poorly done. The mean score, 49%, was significantly lower than in 2015 (59%). The majority of students had difficulty demonstrating a breadth and depth of knowledge across the broad range of topics covered. It was particularly concerning that more than a third of the students achieved less than 50% accuracy.

**Section B: Short-answer Questions**

**Question 16**

1. Most students correctly answered ‘Richter scale’.
2. Some students misinterpreted the diameters of the circles and suggested they represented the area/intensity/zone of local ‘shaking’ rather than the size, magnitude, or energy released by particular earthquakes.
3. Successful answers described the location of the focus correctly stating:

* the latitude, longitude, *and* the depth, or
* 134 km NW of Ternate at a depth of 47 km.

However, others confused the earthquake focus with the epicentre and only wrote the latitude and longitude, or ‘134 km NW of Ternate’.

1. Many students correctly suggested a reason why so many earthquakes occur in Indonesia, explaining that it is located near a plate boundary or in the ‘ring of fire’.
2. Most students correctly suggested one possible cause of a tsunami, such as an extra-terrestrial impact, oceanic volcanic event, or the collapse of a volcanic cone on an island.

**Question 17**

1. Most students correctly named the rock shown in photograph A as a conglomerate, and were able to suggest that the most likely transporting agent was water. Most also correctly described at least one piece of evidence, such as the fragments were ‘rounded’ (or ‘sub-rounded’), or were ‘poorly sorted’, but many struggled with describing both of these.
2. Most students made the connection between the photographs of Earth and Mars. Some thought that the transporting agent in photograph B was wind. Most students who correctly identified the possible transporting agent in both photographs as ‘water’ also named the geological principle as ‘Uniformitarianism’. Others did not pay attention to the scale and thought that the geological principle was a fault. The best responses explained that Mars is a different planet to Earth, with different atmospheric composition and processes, and therefore the principle cannot be applied with complete confidence.
3. Many students knew that life needs water to survive. Some wrote that water is important for life but did not say that it is necessary. Others did not answer the question.

**Question 18**

1. The scale on the vertical axis could be correctly labelled in a few different ways. Some less successful responses incorrectly spaced major values along the axis, or plotted points inconsistently with the labelled axes. Some students struggled to read the values on the horizontal axis from right to left and consequently plotted points incorrectly. Even if the points were plotted incorrectly, most students were able to draw a line-of-best-fit or connect points appropriately for 1 mark.
2. Some students found it difficult to mark the location of the Nazca Plate (bottom left region of the graph) and the South American Plate (top right region of the graph). Students needed to focus on the information provided that identified the graph as a representation of a cross-section of the boundary between the two plates. A number of students drew a horizontal arrow pointing to the right to indicate the movement direction of the Nazca Plate. The more successful responses showed an arrow pointing downward in a direction parallel to the boundary, recognising that the Nazca Plate was being subducted beneath the South American Plate.
3. Many students were able to state that the plate boundary was a destructive boundary, a convergent boundary, or a subduction zone. Less successful responses incorrectly stated that this type of boundary was a ‘fault zone’. Only a few were able to identify that points on the graph showed the foci of earthquakes were at increasing depth towards the east and thus provided evidence that ‘subduction’ was occurring. The more successful responses were able to describe this evidence.
4. Many students either did not attempt this question or calculated values that were far from realistic. Successful responses were based on an understanding that plate movement is generally of the order of 1–3 cm per year. Students who used inappropriate values but showed calculations that were otherwise correct were given some credit. Incorrect responses suggested that a section of the crust would become a mountain range in the short time interval of 3 million years. It was not sufficient to say that the crust would be ‘destroyed’. More successful responses referred to possible melting, magma formation, or metamorphism.

**Question 19**

1. A number of students correctly identified ‘gravity’ and ‘magnetism’ as physical properties likely to be measured using an airborne survey. A number of students incorrectly suggested ‘colour’, explaining that the ground/surface would be darker if there was a metallic ore present. Some students also struggled to give an explanation of density and magnetism of rocks, with several thinking that all metallic ores are magnetic.
2. Many students correctly suggested either geochemical surveys or ground-based geophysics as the next stage of exploration. Less successful responses incorrectly suggested drilling. Drilling is too costly to undertake without more detailed information about the location, depth, and extent of a deposit.

**Question 20**

1. Many students correctly stated ‘porosity’ and ‘permeability’ as the two properties that a rock needs in order to act as an aquifer.
2. Most students could also state that the function of an aquiclude is to stop water escaping.
3. Many students correctly labelled the yellow area as the recharge zone and the dotted horizontal line as the water table.
4. Many students correctly identified that water would be more expensive to extract from Location 1, with most explaining that this well is deeper than that at Location 2 and therefore more expensive to construct. Some students gave the more detailed explanation that Location 2 is below the water table and therefore water would naturally flow out of it.
5. Many students identified that the water in an artesian basin ‘needed to be looked after’ but only the more successful responses explained that the rate of extraction should not exceed the rate of recharge.

**Question 21**

1. Many students incorrectly named Fossil A as ‘Ediacaran Fauna’ or ‘Dickinsonia’ instead of Archaeocyatha, but correctly identified Fossil B as an ammonite.
2. Generally, students struggled to recall that Fossil A was Cambrian and Fossil B was between the Devonian and Cretaceous.
3. Successful responses stated that both fossils were valuable index fossils. Less successful answers described one general feature of an index fossil, for example, being widespread, easily recognised, or occurring over a limited time range.

**Question 22**

1. and (b) Many students were able to identify and describe evidence for the site being an impact crater, for example, iridium, shocked quartz, tektites, or a circular crater.

Some students struggled to explain how the evidence would have appeared.

Less successful responses did not explain that iridium is rarely found naturally on earth but often occurs in meteorites, and is therefore released on impact. Similarly, less successful responses did not explain the cause of the circular shape by noting that rocks from deeper strata are often brought upward to be exposed at the rim of a crater (and not just because the meteorite was ‘round in shape’).

**Question 23**

1. A reasonable number of students recalled that haematite was part of the oxide mineral group; however, some students incorrectly wrote other mineral groups. Most students could also name the metal produced as ‘iron’.
2. Many students struggled to draw a cross-section of an open-cut mine. Less successful diagrams showed an ore body as a steeply dipping seam, which would be inappropriate for an open-cut mine. Other less successful responses did not show or label benches, or failed to include an appropriate scale in their cross-sections. Some showed a plan view, rather than a cross-section.
3. Many could describe how water is used for reducing excessive amounts of dust.
4. Students struggled to correctly state two requirements of the *Aboriginal Heritage Act 1988* that must be met before an open-cut mine is constructed. Unsuccessful responses suggested requirements that Aboriginal people must be financially compensated or that the area must be returned back to its original state. These may be important, but are not covered within the *Aboriginal Heritage Act 1988*.

**Question 24**

1. On the top face of the block diagram, many students were able to appropriately colour or label one part as light grey (siltstone) and another part as black (shale), but in less successful responses students only coloured or shaded half of the face.
2. Some recognised the type of fault as a reverse fault; however, a number of students incorrectly stated that it was a normal fault.
3. Successful responses correctly labelled the hanging wall on the left of the fault line and the foot wall on the right, with arrows indicating horizontal pressure directions facing inward, on both sides. Some less successful responses showed pressure directions vertically, from the top and bottom.
4. Successful responses identified that the sea level had risen after the sandstone was deposited and explained that sand is generally deposited in shallow water whereas siltstone, which is composed of finer particles, is deposited in deeper water. A number of students wrote that the sea level had fallen but could not explain why.
5. Most students could describe evidence that one other process had occurred, such as metamorphism (which had formed the marble or slate), erosion (which had removed the shale from the top left side of the block diagram), or glaciation (which had deposited the tillite).

**Section C: Extended-response Question**

**Question 25**

There was a huge range in quality of answers for the extended-response question.

**Discussion point 1**

A number of students misinterpreted the question and read it as ‘rock type’ instead of ‘rock types’. As a result, students compared the formation of sedimentary rocks with igneous and metamorphic rocks rather than discussing rock types with fossils (e.g. sandstones, limestones, mudstones, and shales). Students were given credit for correctly describing sedimentary rocks.

**Discussion point 2**

This was the most poorly answered point. Some students correctly linked the change in eras with major changes to dominant life forms, for example, mass extinctions, an explosion of life, development of basic life, or formation of modern life. Many of the less successful responses did not refer to any of the specific eras in the geological time-scale, which was disappointing.

**Discussion point 3**

Successful responses noted that the formation of stromatolites was due to the activity of cyanobacteria, and hence evidence of early life on Earth. Less successful responses, however, did not continue on to explain that cyanobacteria produced large amounts of the first oxygen in the Earth’s atmosphere, which allowed for the subsequent evolution of life on land (including animals).

**Discussion point 4**

This was the best-answered point, with many students recalling that the fossil record provides an incomplete history of early life on Earth because soft-bodied organisms were more often destroyed, required special conditions to be preserved, had since been destroyed by metamorphism, or were in hard-to-reach places or buried too far underground.

**Communication**

Students were given credit for including a field example. The more successful responses were able to describe, for example, the location of a fossil bed they had observed in their field work, and/or a diagram of a particular fossil type they had found in the field. Less successful responses included neither a diagram nor a field example, which was disappointing. Some students forgot to label their diagram or to include an appropriate scale. Many students drew a diagram of a stromatolite but did not refer to the diagram in their response or explain how the structure had developed.

## Operational Advice

School assessment tasks are set and marked by teachers. Teachers’ assessment decisions are reviewed by moderators. Teacher grades/marks should be evident on all student school assessment work. In particular:

* a cover sheet summarising the tasks submitted within each assessment type is very helpful
* work should not be presented in folders, which are very bulky to handle.

## General Comments

Teachers are reminded that the following useful resources are available on the [Geology minisite](http://www.sace.sa.edu.au/web/geology/stage-2/support-materials/subject-advice-strategies):

* checklist of required elements in field and practical investigations
* Practical Skills Assessment (A3 and I3)
* Risk Assessment and Work Skills Assessment (A3 and I3)
* Teacher Observation Notes (A3 and I3)
* Work Skills Assessment Sheet (A3)
* Working Collaboratively Assessment (A3).

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