GCE AS EXAMINERS' REPORTS

GEOLOGY
AS

SUMMER 2022

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COMPONENT 1: GEOLOGICAL ENQUIRIES

General Comments

Generally, there was a range of marks across all questions and the paper differentiated well. Candidates were comfortable with the exam style and process, with very few questions left blank. Overall, there is evidence that candidates may have lost marks due to lack of clarity rather than knowledge, with candidates often not fully answering questions, often inferring or lacking detail despite having answers that were heading in the right direction. The extended writing QER questions were once again less well answered, and mathematical questions were less consistently attempted than in the 2019 examination series.

Comments on individual questions/sections

Q.1 There was a considerable range with regards to the quality of answers produced in this question, with the early part of the question answered better and part (d) answered least well.

(a) Part (a) was well answered, with most students able to give a range of reasons for reasons for identifying a pluton.

(b) Part (b) was generally well answered but a considerable minority of candidates failed to describe the test and a smaller minority added the same test twice. There also remains a tendency for candidates to **state** a test, rather than **describe** a test, especially with hardness. Candidates should describe the use of the relevant equipment i.e.scratch with a steel pin or copper coin.

(c) Part (c) required the candidates to detail the evidence for the identification of the dyke and for its formation from peridotite. Generally, parts i and ii were answered more strongly, with many candidates able to identify the difference between a mafic and ultramafic material in iii. However, there was a lot of confusion about partial melting, how the compositions relate and how peridotite could have been the source of the mafic rock. This limited the marks given.

(d) Part (d) was generally less well answered, with many candidates unable to calculate the interquartile range. Candidates tended to discuss the variation in crystal sizes rather than there being two distinct clusters, and there was a poor understanding of statistical techniques and their uses. The Mathematical Guidance booklet produced by Eduqas is a useful guide to help candidates access these questions.

Q.2 (a) Part (a) was very well answered, though a minority of candidates drew their own scales rather than using the one given, so lost marks.

(b) Most candidates were able to identify the rock as a sandstone, but the reasons given were often related to the environment of deposition rather than the identification of the rock. It should be noted that orthoquartzite is on the specification rather than desert sandstone. A number of students noted porosity as evidence for identifying this rock, for which no marks were awarded.

Q.3 (a) Part (a) was generally well answered. There as a distinct minority that still struggled with scale and others that tried to draw the whole specimen.

(b) Question (b) differentiated well with some fantastic and creative answers. Many candidates were able to identify the structures in the photographs but some failed to link this to the question so received no marks. Others were very logical and provided key reasons for why a structure was, or was not, formed by the trilobite. A few candidates wrote about the environment of deposition of the structures rather than their formation, or otherwise, by the trilobite. Many noted that the coprolite was far too large for the trilobite.

Q.4 (a) Part (a) was answered quite poorly with many candidates identifying the fault or metamorphic aureole as the unconformity. The arrow should be within 1mm of the line marking the unconformity, as has been standard in previous exams.

(b) There was a range of responses to this question. Many candidates could identify the garnet but the ability to identify the rock type or the texture was less successful.

(c) Responses to six-mark questions remain weak with part (c) being the most likely question to be omitted by candidates. The highest achieving candidates followed the bullet points well and explained age relationships, rock types and type of metamorphism in a systematic fashion. Those who achieved 5 or 6 marks often made notes at the top and referred back to answers in questions 1-3. There was a lot of confusion between rock types that formed from contact and regional metamorphism and there were also some problematic descriptions of the formation of rock types. Some candidates started to state relevant points but did not link them to actually answer the question. A very small minority did not focus on Map 2 but instead discussed just Map 1 which made it harder for them to access the full range of marks.

Q.5 This question provided a wide range in the quality of responses, but the naming of both fault types proved particularly difficult for many candidates. There was a mixed response to the question concerning the relative movement of the hanging walls, but most were able to estimate a suitable angle for the fault plane. The requirement to state the direction of dip of the fault plane also received mixed responses.

Q.6 There was a considerable range with regards to the quality of answers produced by candidates from different centres. Some centres had many candidates scoring more than ten marks, while other centres had few. Overall, it would appear there is an improvement in recent years suggesting candidates are becoming more confident in interpreting this style of map.

The most common errors included not having the boundaries of F-D and D-E in the correct places to the east of F2, unconformities being in the wrong place and cross-sections not showing cross-cutting relationships above the surface. Some candidates were unable to locate the pluton and metamorphic aureole. There was also a considerable minority not using rulers or protractors and it should be recommended to candidates that they ensure beds are plotted as accurately as possible.

Summary of key points

- Overall, candidates followed the exam format well and the distribution of marks indicates excellent levels of differentiation.
- Candidates were most successful when they related their answer to the key words in the question e.g. in Q4c where candidates clearly noted each bullet point in their discussion and related it back to the suggested conclusion.
- Candidates are finding mathematical questions and those relating to using various scales particularly challenging. In particular, Q1d highlighted the use of statistics in geology as an area that could be improved.
- Mapwork appears to be improving and remains well attempted, but the correct drawing of geometry (placement of angled beds) remains less well developed and requires further exploration.

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COMPONENT 2: FOUNDATION GEOLOGY

General Comments

Overall, the paper was answered well by candidates and was able to differentiate effectively with a good range of marks. Very few questions throughout the paper were left blank showing a high level of accessibility. There were some questions on content which had not yet been examined at this level since the publication of the new specification, such as silicate structures. These were areas that candidates generally achieved less highly. Candidates are used to the examination style and responses generally contained the relevant amount of information for the marks available.

Comments on individual questions/sections

Q.1 Candidates were able to access this question well, although would have benefitted by including more specific content in their answers

(a) (i) This is a standard question for AS level Geology – to describe the texture of a rock from a photomicrograph. Most learners recognised that the rock had a crystalline texture and were then able to pick up marks based on discussion of shape and size of the crystals present, as well as their random orientation. It is worth noting that many candidates described the crystals as coarse, which, while true, is not enough for credit. Candidates should look to use the scale provided and quote a range of sizes.

(ii) The majority of candidates were able to correctly identify the rock as granite based on its crystal size and mineral content.

(b) (i) This question was not answered well, and candidates were unable to state two products of the chemical weathering of the granite shown. Many simply stated the minerals which were labelled in Figure 1b as the products of weathering. Quartz fragments was an acceptable answer, although, just ‘quartz’ was not since the mineral quartz is not a product of weathering. Furthermore credit was to be given for evidence of the understanding of processes rather than copying the labels from the diagram.

(ii) This question was not answered well as many candidates did not focus their response on the chemical weathering of the stated rock, granite, and discussed weathering by acid rain or carbonation. Candidates who scored well noted that the rock contained feldspars which break down by hydrolysis or that the more iron-rich minerals break down by oxidation.

(c) Candidates were not required to know about processes specifically related to lichen, fungus or algae to answer this question but should have applied their knowledge of biological weathering to the information given, to suggest possible processes. Most candidates noted that the biological material would contribute to the weathering of the rock (biological weathering) and then expanded on that, developing ideas related to root action. Some candidates also wrote about the possible contribution of organic acids to weathering.

(d) This question was answered poorly with very few answers showing an appreciation of the meaning of the term flocculation. Many candidates referred to flocculation as a process of weathering or erosion. Candidates who scored well noted that flocculation allows clay particles to combine due to marine salinity neutralising their surface charge, which allows clay particles to coalesce prior to being deposited.

Q.2 Candidates scored low marks in the first two sections but generally picked up more marks on parts c) and d).

(a) (i) Very few candidates were able to recognise the silicate structures from their diagrams. Many used the term lattice for Grain B, however, all silicate structures are in lattices – the structure comes from how that lattice is then arranged.

(ii) Candidates were able to pick up marks by recognising that if grain A had been eroded to a smaller size, it must have a weaker silicate structure. However, few candidates were able to develop this idea and explain why that is the case. Candidates needed to link the weakness, or strength, of the silicate structures to their chemical bonds. This in turn should have led to a discussion about the presence and effects of cleavage in the case of grain A, or of the lack of cleavage in the case of grain B.

(b) Most candidates correctly identified the mineral from the information provided. Some candidates failed to recognise the fact that single chain silicates develop cleavages at 90 degrees to one another, which lead to some identifying the mineral incorrectly as hornblende.

(c) (i) Most candidates used Figure 2b effectively to read off the flow velocity at the time of deposition for the two grains. Some candidates lost out on these marks due to inaccuracy of readings and candidates should be encouraged to draw lines on graphs with a ruler to ensure accuracy.

(ii) Candidates were able to access this question well and noted that shape and density were two factors which affect the flow velocity of a river at which a grain will be deposited. It is worth noting that many candidates suggested weight as a variable – weight should not be confused with mass or density as it is a force measured in newtons.

(d) Most candidates accessed this question well and stated processes of erosion or transportation. Marks were lost when candidates either did not explain the processes or focussed only on erosion and not transportation.

Q.3 This question contained the first of two QER sections as well as some need for mathematical calculations which some candidates found challenging.

(a) (i) Most candidates showed a good understanding of how to calculate the geothermal gradient. However, not all calculated it from the surface to the MOHO, a depth of 30 km. As in question 2 (c) candidates achieved the most success when they drew a line onto Figure 3b to accurately find the temperature.

(ii) Overall this question was answered poorly and despite the lithosphere being labelled on Figure 3a, candidates measured the thickness of the crust. Some candidates did not show an understanding of how to calculate percentage change.

(iii) Candidates who identified the need to use Figure 3b to answer this question did well and were able to extrapolate the geotherm and melting point curve to 60 km and find the answer. A considerable number of candidates did not read the question carefully and stated a temperature as opposed to a depth in their answer.

(iv) The question was not answered well, with many candidates incorrectly attributing the presence of granitic magmas to the subduction of plates. Candidates failed to link this question to part a(ii) where the lithosphere was identified as being thicker than usual. This would cause the crustal rocks to be deeper than usual, allowing the geotherm to cross the melting point for granite, allowing partial melting and granitic magmas to form.

(b) (i) The vast majority of candidates were able to identify slate as the rock shown in Figure 3c.

(ii) This question was answered well and candidates showed a good understanding that slate formed from the low-grade regional metamorphism of a fine-grained sedimentary parent rock, such as shale or mudstone.

(c) The first of the two QER questions proved difficult for some candidates. Whilst the question was related to Figure 3a, it also required candidates to have a knowledge of Hooke's Law and the factors that affect how a rock deforms. Most candidates were able to disagree with the statement, stating that pressure also had an impact on how rocks deform. The best answers were able to link this to Figure 3a, as the question asked, and noted that whilst folding occurred at all depths (shallow and deep) faulting only occurred closer to the surface where rocks are colder and more brittle. To achieve 5-6 marks candidates were required to clearly communicate understanding of some factors affecting deformation and to use key terminology correctly. A few candidates went on to identify other factors such as pore fluid pressure, rock competence and rate of strain, so demonstrating a thorough understanding of the topic covered.

Q.4 This question was generally answered well, with the exception of part (d)i where candidates tended to respond with insufficient depth.

(a) (i) Most candidates were able to successfully label the umbo and hinge lines on specimen C. Some candidates chose to label the hinge line on the bottom diagram which led to more errors confusing the hinge line with growth lines.

(ii) The vast majority of candidates were able to draw two lines of symmetry on specimens C and D.

(b) Most candidates were able to answer this question successfully, recognising the need to measure the dimensions of specimen D on the upper diagram. Credit was awarded to those who were able to accurately record measurements of the specimen even if they were unable to calculate the ratio effectively.

(c) Most candidates were able to recognise a brachiopod and bivalve in specimens C and D, however, there was some misunderstanding as to which was which.

(d) (i) This section posed the most difficulty for candidates on question 4. Those who were able to identify habitat 2 as the most likely habitat were unable to correctly describe the morphological features to explain their answer. Whilst the pallial sinus and shape of the shell were the key features, to gain full credit they needed to be explained, siphons linked to the pallial sinus, and shape for ease of burrowing.

(ii) Most candidates were able to pick up marks here for stating that trilobites were extinct and bivalves still had modern living relatives. The second mark, explaining that uniformitarianism could be used to interpret mode of life for bivalves, proved more challenging.

(iii) This is a common question regarding the limitations of the fossil record. Most candidates picked up marks here although many candidates struggled to provide enough information to achieve the full three marks.

Q.5 This question contained the second of the two QER questions and those who were able to link interplate and intraplate tectonic settings to the hazards produced, scored well.

(a) (i) The vast majority of candidates were able to annotate the diagram to show that plates converge at a subduction zone indicated by an ocean trench.

(ii) A good number of candidates were able to link intermediate magmas to subduction zone volcanism.

(iii) Candidates scored well on this question, noting that the production of magma is linked to the subducting plate. Some missed out on marks by not stating what was being partially melted.

(b) Most candidates noted that they were required to calculate the size of one of the small squares (40,000 m^2) and multiply this by the number of squares under the grid, not covered by land in the second image. Errors came from not calculating the size of the square correctly, as many stated the size of a small square as 200 m^2.

(c) This QER question required candidates to discuss the differences in magma produced at a subduction zone and an intraplate setting. Most candidates were able to link differences in viscosity to eruption style. However, fewer were able to present discussions regarding the gas content and silica content of the magma. Some candidates failed to recognise that an intraplate setting meant that the Hawaiian volcanoes are located away from plate boundaries. Candidates who were able to explain multiple reasons for differences in eruption style were able to achieve the higher mark bands.

Q.6 This question proved to be the most accessible on the paper with the majority of candidates scoring well.

(a) (i) Similar to question 1(a)i candidates were required to describe the texture of the rock from the diagram. Most candidates recognised that the rock had a clastic texture and described the texture accordingly using the size, shape and sorting of the clasts. Again, candidates should be encouraged to use the scale and quote measurements to back up statements such as coarse or fine.

(ii) The vast majority of candidates were able to recognise the rock shown in Figure 6b as a conglomerate. Those who described the rock as having angular shaped grains in part i were awarded an error carried forward mark if they then named the rock as breccia.

(b) Most candidates were able to identify the boundary as an unconformity, but many struggled to gain full marks for explaining how it formed. Few candidates recognised the need for uplift or a change in sea level to move from a depositional setting to a period of erosion, although this was not necessary to attain full marks.

(c) (i) The vast majority of candidates were able to recognise fault F1 as a normal fault and explained this with a statement about the relative movement of either the hanging wall or the footwall.

(ii) Many candidates correctly calculated the vertical displacement of fault F2 using the marker bed shown and recognised that the scale required a x2 calculation. Some calculated the net displacement as opposed to the vertical displacement.

(d) The vast majority of candidates were able to correctly decipher that the faults could not have occurred at the same time due to F1 being displaced by F2, and F1 stopping at the unconformity, unlike F2. Fewer noted that they were formed by the same tectonic forces, tensional, as they were both normal faults. Some candidates stated that because they were formed at different times, they could not have been created by the same type of force. It is worth differentiating that the same type of force can occur at different times.

Summary of key points

- Candidates need to make greater use of graphs to ensure that calculations are accurately based on the information that has been provided – candidates should be encouraged to draw on graphs.

- Candidates should be aware of scales on diagrams and use them effectively to quote actual sizes of grains/clasts/crystals when describing the texture of rocks.

- There should be an understanding that, while there is a lot of information given for candidates to work from for QER questions, there can be some requirement for them to use their own knowledge and apply it to the situation given. QER questions can be an area where candidates should be able to show their depth of understanding of geology.

- It is worth noting that some of the questions which received lower marks are those on topics that have either moved from the previous A2 specification to the new AS specification (flocculation, fossil morphology and mode of life), or are topics that were not on the previous specification (silicate structures).

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