# GCSE EXAMINERS' REPORTS

## GEOLOGY
## GCSE

## SUMMER 2019

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# GEOLOGY

## GCSE

## Summer 2019

## COMPONENT 1

### General Comments

### Mean mark 44/80

The online component has changed from previous years in that now there is less emphasis on multiple choice questions and a greater emphasis on extended response type questions. The multiple choice questions accounted for 25 marks out of 80, whilst the extended response questions worth 3 to 6 marks accounted for 31 out of 80. The remaining 24 marks were allocated to questions requiring short written answers worth one or two marks.
In addition, the new specification requires the identification of maths and practical marks, in this case these were 13 and 8 respectively.

The paper tested a wide range of topics across the specification and produced a very good spread of marks which ranged from 4 to 78 out of 80. It was noticeable that a significant number of candidates found the maths-based questions quite challenging and it was disappointing to see a number of candidates making no attempt to complete these questions.

A number of candidates failed to follow the instructions in the questions and only 'ticked' one multiple choice box when two were clearly required. A small number of candidates failed to insert the links from Locations A, B and C to an appropriate plate boundary in question 4.(a)

Many candidates' answers were far too brief to access the full range of marks for the six mark [QER] questions. A number of candidates produced only one or two lines of text and consequently were limited to marks in the lowest scoring band.

### Comments on individual questions/sections

**Q.1** Maximum mark 17, mean mark 7.9, facility factor 46.7%

Overall this question was a good discriminator between candidates particularly on sections (b) ii, (c) ii and (d) ii.

The majority of candidates identified the Silurian rocks to be dipping at 90° and the rocks were from the Palaeozoic era. Incorrect responses included 0° and 15° whilst Carboniferous, Jurassic, 444 and 419 were given instead of the era.

The majority of candidates identified Figure 1b as being poorly sorted and angular but many then failed to identify it correctly. Surprisingly, given that rock fragments and clay matrix were labelled on the photograph the most common answer was granite, followed by breccia and conglomerate. Candidates clearly need training on the use of scale on photographs and need to make use of all the data available before answering.

Although many candidates identified Figure 1b as granite they then correctly identified the two correct statements in (c) i which referred to distance of transport and sorting.

Only the stronger candidates gave valid reasons to explain the lack of fossils in the Silurian and Devonian rocks. Answers which referred to the environment of deposition being high energy, erosive, having low preservation potential, were deserts/terrestrial scored well. Many candidates were under the illusion that life had simply not evolved yet, so no fossils could be formed.

Most candidates recognised boundary A as an unconformity and there were many excellent answers describing in detail the geological events that had occurred to create it. Very few answers referred to James Hutton or the concept of Deep Time, but this did not prevent them accessing the full mark range.

**Q.2** Maximum mark 12, mean mark 7.8, facility factor 64.9%

Planetary Geology is a new component in GCSE Geology and it appears that centres have prepared candidates well for this topic.

Most candidates identified the origin of the craters on Mars due to meteorite/asteroid impacts and the shape was circular. A minority of candidates thought the craters were spherical and formed by volcanic eruptions.

The calculation of the area of the Hadley crater was answered well overall, but a few candidates used the diameter (120 km) instead of the radius (60 km) to calculate the area and lost one mark. A small number of candidates made no attempt at this question.

The relative age of the craters was answered correctly by most candidates and most cited cross-cutting relationships as the principle used to determine the relative age. Incorrect answers suggested uniformitarianism and radiometric dating as geological principles.

The extended response [6 QER] question proved to be a very good discriminator. There were many outstanding answers that included just about everything on the mark scheme and the majority of candidates scored 3 or more out of 6. Poor performances were characterised by candidates just focusing on one idea which was then poorly explained. Many of these answers failed to address why Mars had many well preserved craters whilst Earth had few poorly preserved craters. Mars has no human life therefore trampling by humans to erode them does not occur was a common response. It was a little surprising to find that many candidates did not refer to the differences between Earth's and Mars' atmosphere to account for the differences. Overall the quality of response on this [6 QER] question was much better than the one on volcanic activity in question 4.

**Q.3** Maximum mark 14, mean mark 7.7, facility factor 54.8%

This question elicited quite polarised response with candidates either scoring very highly or very poorly.

Calculating the mean angle of dip for the beds striking NW-SE proved problematic for many candidates. A significant number of candidates gave the answer as 12°as they did not understand NW-SE strike. A large number of candidates were unable to add the 4 values together and conclude that the mean was 43°.

Every option was ticked in questions 3 (a) ii and iii but most candidates correctly identified the fossils as cephalopods with suture lines.

Many candidates correctly identified C as a goniatite as it had the simplest /shortest suture line and was the oldest/Carboniferous in age. A small number of candidates gave 1, 2 or 3 as an answer instead of A, B or C. A few candidates gave K as the answer which was the label pointing to the suture line.

The majority of candidates were very familiar with the characteristics of a zone fossil and most scored 3/3 on this question. The most popular answers were evolved rapidly, wide geographical distribution, abundant and had hard parts suitable for preservation. A minority of candidates misinterpreted the question and instead described the suture lines and morphology of the cephalopods shown in Figure 3a.

The final part of question 3 was another good discriminator. The strongest candidates scored full marks here with sound reasons to explain their choices of locations. The weaker candidates randomly inserted the locations 1, 2 and 3 next to the fossils A, B and C but then failed to give any reasons based on Figures 3a and 3b. A small number of candidates put the same number in each box in order to guarantee scoring one mark once again failing to give any reasons to explain their choices.

**Q.4** Maximum mark 17, mean mark 8.8, facility factor 51.6%

Section (a) produced a wide range of responses but only a minority of candidates scored 3/3 here. A small number of candidates failed to link locations A, B and C to the appropriate type of plate boundary as they failed to 'click' on the options to connect them with red lines.

The majority of candidates identified location B as a conservative boundary but there was much confusion over locations A and C. Very few candidates were confident enough to link locations A and C to the same type of boundary (convergent oceanic-continental) even though it was stated in the stem that a boundary could be used more than once. It was disappointing to see that a number of candidates thought that locations A and C were divergent or convergent continental-continental.

Section (b) was well answered by the majority of candidates. Most candidates correctly identified the two statements which described the pattern of earthquakes shown in Figure 4.

Most candidates scored one mark on (b) (ii) for referring to subduction, but many failed to secure the second mark by elaborating with reference to pressure/friction building up then being released. The fault calculation was a good discriminator with the more able candidates gaining both marks here. The most common cause for error was failing to convert 700 kilometres into centimetres before dividing by 25 million. Part (iv) proved very straightforward for most candidates as the majority cited thrust fault and volcanic activity not being associated with the Alpine Fault.

The extended response [6 QER] question was not as well answered as the one on Planetary Geology in Question 2. The quality and quantity of responses were very variable and only a relatively small number of candidates gained full marks. In order to achieve full marks a balanced answer was required, firstly to explain the formation of magma to form the volcanoes and secondly to explain why these volcanoes have violent eruptions. The majority of candidates recognised that subduction of oceanic lithosphere was involved but few went on to explain how the release of water led to the partial melting of the overlying mantle to form andesitic magma. Many answers were vague and referred to melting of rock and that earthquakes also were involved in the process.

Many candidates failed to address the second part of the question in explaining why the volcanoes erupted violently. Relatively few candidates referred to andesitic magma being relatively silicic and viscous and that gases could not escape freely so pressure built up. A few candidates described the volcanoes as being basaltic with effusive eruptions.

**Q.5** Maximum mark 7, mean mark 3.9, facility factor 55.7%

The maths question in (a) was the best answered maths question on the entire paper with most candidates correctly giving 2250000 $m^3$ as the volume of the mineral vein. Only a minority of candidates failed to score marks here and they tended to add 2, 750 and 1500 together rather than multiplying them.

Nearly all candidates correctly identified mineral E as galena using the data sheet and the information from Figure 5b. However, a small number of candidates appear not to have used/accessed the data sheet as answers included slate, garnet and peridotite.

The order of crystallisation of the minerals in the hydrothermal vein was correctly identified by the majority of candidates as haematite, galena, calcite. Some candidates reversed the order calcite, galena, haematite and failed to gain credit.

Describing the processes responsible for the concentration of metals was a good discriminator with only the stronger candidates being able to refer to metals being dissolved out from a large volume of rock then being re-deposited in a more concentrated form. Most candidates picked up one mark for referring to hot water or hydrothermal activity being responsible.

**Q.6** Maximum mark 13, mean mark 7.6, facility factor 58.8%

This question had the highest percentage of multiple choice style questions (8 out of 13 marks) and was the most accessible question on the paper. Many candidates scored 10 or more marks on this question.

The majority of candidates correctly identified the two correct statements based on Figure 6a. A small number of candidates only ticked one box instead of two, needlessly throwing away one mark by not reading the instructions.

Calculating the geothermal gradient proved problematic for many candidates and common incorrect answers were 25° $Ckm^{-1}$ and 0.4°$Ckm^{-1}$. A large number of candidates failed to realise that the temperature at 5 km depth was 200°C and only a very simple calculation was needed. A small number of candidates added the depth and temperature values together and ended up with answers in thousands of ° $Ckm^{-1}$.

The multiple choice questions in (b) and (c) were well answered by the majority of candidates but once again a few candidates only ticked one box instead of two in (b) (ii).

Question (c) (iii) was the least well answered with only about half the candidates realising that reserves are the proportion of resources that can be extracted at a profit.

The final question regarding burning fossil fuels and climate change was very well answered by the majority of candidates. Carbon capture and storage (carbon sequestration) was well understood by many candidates and explanations were often very detailed and many candidates scored full marks here. Some answers were overlong compared to the number of marks that were available.

**Summary of key points**

- Multiple choice questions – make sure candidates double check whether correct or incorrect statements are required for answers. Double check the instructions regarding how many boxes need to be ticked. As a rule, if there are 5 options it will require one tick, if there are 6 options then 2 ticks will be required.

- Make sure candidates are aware of the information available on the data sheets. The data sheet is likely to be used in every examination.

- Ensure that candidates are confident in using the 8 points of the compass. This will help eliminate careless errors when referring to dip and strike values on geological maps.

- Encourage candidates to look carefully at the scale bars on Figures used in examination questions. This is particularly important when describing the texture of rocks from photomicrographs.

- Encourage candidates to tailor the length of response to the marks available for the question. An extended [6 QER] response is likely to require a minimum of 10 lines to achieve marks in the highest band level. A 3-mark question can be adequately answered in 4 or 5 lines.

- Double check answers requiring mathematical calculations and make sure the decimal place is in the correct position.

- Encourage candidates to read through their answers at the end if time permits to check for any mistakes or omissions.

**GCSE GEOLOGY**

**GCSE**

**Summer 2019**

**COMPONENT 2**

## General Comments

**Mean mark 40.6/80**

The Component 2 paper included short and extended questions based on Map 1. Component 2 is an investigative paper that requires candidates to use practical skills and techniques listed in Appendix B in the specification. Maths skills were also assessed in the paper and accounted for 19 marks.

The paper tested a wide range of topics with an emphasis on the rock groups, minerals, fossils and structural geology. Candidates produced a wide range of marks, from 0 to 72 out of 80. It was noticeable that many of the candidates found the map work questions quite challenging, particularly recording dip and strike measurements from the map and the partial cross-section construction.

Many of the candidates did not relate their answer to the evidence in the figures for the QER question and repeated the question in their answer. As so many were not specific, and also brief with their answers, they were limited to marks in the lowest scoring band.
Although many students managed to successfully plot the rose diagram and sedimentary log a number of candidates were unable to complete these practical skills. The sketching was generally of a good standard with many candidates achieving high marks for these questions. Mineral identification was generally done well.

## Comments on individual questions/sections

**Q.1** Maximum mark 20, mean mark 10.6, facility factor 53.1%

**(a)** **(i)** Many candidates did not draw the crystals to the correct size and grains were drawn rather than crystals.

**(ii)** Very few candidates correctly identified the rock as having a crystalline texture. Many candidates thought that it represented a porphyritic texture.

**(iii)** Nearly all candidates were able to explain the texture as slow cooling from magma. As so many incorrectly identified the texture they were unable to access the reserve mark of one stage of cooling.

**(b)** **(i)** Many candidates were able to measure the orientations of the crystals. However many missed this question and added up the tallies in the table without recording the crystals in Figure 1b.

**(ii)** Most candidates were able to correctly complete the rose diagram however it was apparent that many did not know this practical skill and used crosses rather than shading the segment or left it blank.

Candidates were awarded marks for a correct plot based on the numbers given in question (b) (i)

**(iii)** Almost all candidates correctly identified the direction of the flow and were able to give a reason. The majority of candidates were unable to explain that the flow aligns the crystals.

**(c)** Many candidates were able to identify the rock as granite however many thought it was a mineral (quartz) or a metamorphic rock. Candidates were able to use the information in Figure 1b relating to crystal size and minerals composition however a number did not use this information in their answer.

**(d)** Overall this question was answered well. The majority of candidates were able to identify that the igneous bodies were both intrusions and could make a size comparison, however a number stated that they were both igneous bodies which was a repeat of the question. A number did not reference both igneous bodies A and B in the similarity and difference.

**(e)** The majority of candidates were able to identify both igneous bodies.

**Q.2** Maximum mark 23, mean mark 9, facility factor 39.1%

**(a)** **(i)** The completion of a cross section is a new skill to be assessed in the new GCSE and a small number achieved full marks. Some of the candidates were able to correctly plot the beds above the unconformity. Fewer candidates were able to plot the dyke. Many candidates plotted beds dipping towards the east, continuing the anticline, others plotted vertical beds.

**(ii)** Many candidates were able to correctly identify the fold as an antiform however very few were able to draw a vertical fold axis and plotted it as a horizontal line above the cross section.

**(iii)** The calculation was answered correctly by a number of candidates however many did not use 600 C.

**(iv)** Those who achieved the calculation marks correctly plotted the metamorphic aureole however many candidates did not attempt this question.

**(v)** Generally, this question was answered poorly. Many candidates were able to state the strike directions however very few measured the correct dip angle from Figure 2a. Many dip directions were given as two directions.

**(b)** **(i)** Many candidates were able to measure the mean size of crystals and some correctly identified the rock as metaquartzite. Some identified the mineral as olivine and therefore did not access subsequent marks Very few students correctly identified the rock with most identifying it as sandstone.

**(ii)** Many candidates misinterpreted the question and thought that they had to explain the difference between a lava flow and a sill. Many candidates did not relate the evidence to Map 1 and Figure 2b.

**(c)** The first part of this question was answered correctly by the majority of candidates and cited cross cutting relationships. Only stronger candidates were able to explain that it is not possible to determine the age relationships in the second part of the question.

**Q.3** Maximum mark 17, mean mark 9.8, facility factor 57.6%

**(a)** Overall students were able to correctly plot the sedimentary log. Most correctly plotted Bed 2 and 3 however many did not plot the correct grain size for the conglomerate.

**(b)** The majority of candidates correctly identified the ripples and answers generally referred to transport by wind or water and a current.

**(c)** **(i)** The graptolite was drawn well, with very few students not achieving the correct scale.

**(ii)** Many candidates were able to correctly label a theca however many did not achieve the mark due to inaccurate labelling.

**(iii)** Many candidates identified the fossil as a graptolite.

**(d)** The extended response question [6QER] question proved to be a very good discriminator. The quality and quantity of answers were variable and only a relatively small number of students achieved full marks. In order to achieve full marks, candidates were required to refer to the information in all of the Figures and Table 3 and relate their answer to both the energy levels and the environment. Candidates who discussed and explained each bed in a sequential order from the oldest to youngest scored high marks. Poor performances were characterized by candidates repeating the question in the answer and simply stating that there were different rocks which indicated different energies and different environments without being specific to the information provided in the question.

**Q.4** Maximum mark 10, mean mark 6.4, facility factor 63.7%

**(a)** **(i)** This was a very accessible question with the majority of candidates achieving a minimum of 2 out of 5. Many candidates achieved 4 out of 5. High marks were awarded for sketches representing the correct dip of the fault and beds.

**(ii)** Most candidates were able to label the downthrown side of the fault however a number missed the question out.

**(iii)** Many candidates measured the throw of the fault rather than the displacement. The throw of a fault is not on the GCSE Specification.

**(b)** A high number of candidates were able to correctly identify the type of stress that formed the fault. Only the stronger candidates were able to identify a reverse fault and include the hanging wall or footwall to explain in their answer.

**Q.5** Maximum mark 10, mean mark 4.8, facility factor 47.9%

**(a)** **(i)** The majority of candidates were able to correctly identify both tests and were able to give a good test description. Some did not include both the copper coin and fingernail for the hardness description.

**(ii)** The majority of candidates incorrectly identified the rock as calcite or halite.

**(b)** Many candidates confused this question with oil traps. Stronger students were able to evaluate the suitability by explaining that limestone is permeable and therefore unsuitable for a reservoir as leakage would occur. A small number of candidates were also able to mention that the fault may cause leakage and could reactivate.

**Summary of key points**

In response to a number of the issues raised in this report, centres are recommended to:

- Encourage candidates to refer to the figures and tables mentioned in the question.
- Make sure candidates are using the scales for drawing the rocks, fossils and geological structures.
- Encourage students to draw sketches free hand rather that with a ruler.
- Encourage students to answer the QER questions, by either discussing each figure in order or, if there is a log, to start from the oldest bed to the youngest bed. Alternatively highlight the key terms in the question and refer to all in their answer.
- Make sure that candidates draw crystals for igneous rocks rather than grains.
- Encourage candidates to check the paper for questions that require a label on a figure as these questions are often missed out.
- Encourage candidates to label accurately, with the arrow touching the feature.

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