GCE AS EXAMINERS' REPORTS

GEOLOGY
AS

SUMMER 2019

Grade boundary information for this subject is available on the WJEC public website at: https://www.wjecservices.co.uk/MarkToUMS/default.aspx?l=en

Online Results Analysis

WJEC provides information to examination centres via the WJEC secure website. This is restricted to centre staff only. Access is granted to centre staff by the Examinations Officer at the centre.

Annual Statistical Report

The annual Statistical Report (issued in the second half of the Autumn Term) gives overall outcomes of all examinations administered by WJEC.

GEOLOGY

GCE AS

Summer 2019

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. New aspects to the course, such as Q5c were less well answered, but maths questions were more consistently attempted than last year, and often with better results.

Comments on individual questions/sections

Q.1 Overall candidates accessed this question well.

(a) Part (a) was well answered, with most students attempting the maths. Some candidates repeated the property already given on the resource sheet, while a significant minority chose properties that could not be tested from a micrograph. Candidates should consider the properties most appropriate for the situation and mineral.

(b) Part (b) required the candidates to explain why the rock demonstrated one rate of cooling and why it may have formed underground, but many only discussed one point, or did not relate the piece of evidence they chose to the characteristic. This limited the marks given.

(c) Part (c) was generally well answered but there were many students who missed marks because they failed to identify the differences between the two minerals. There also remains a tendency for students to state a test, rather than describe a test, especially with hardness. Candidates should describe the use of the relevant equipment i.e. scratched with steel pin or copper coin.

Q.2 Overall this question was the least accessible to the students, with a mean mark of 6.6 out of 13 and a facility factor of 50.4,but discriminated very well.

(a) Part a) proved a good discriminator with some students able to answer the section well, while others were able to record the finer-grained beds, whilst struggling with the graded bed 3.

(b) Part (b), where the correct answer was the goniatite, was unexpectedly poorly answered, with many candidates choosing ammonite. Generally, candidates discussed suture lines but levels of suture complexity were often confused.

(c) Part (c) was often had weak answers with many students focusing on either the marine or delta aspect of the question, and often confusing the evidence given. Weaker students tended to focus on the finer-grained properties of the sedimentary log, while others focused purely on the fossils.

The mid-range marks started to bring the rocks and fossils together, and occasionally referred to energy levels. There was a general lack of discussion of the ripple marks and they were not always identified as a marine feature. The high-level answers were able to discuss the concept of a cyclothem, a very small number discussed the importance of uniformitarianism and were able to discuss the importance of the plant as a land feature, whilst the goniatite was a marine organism, showing the movement from marine to fluvial. There were some excellent answers discussing foresets and fining-up sequences.

Q.3 **(a)** Part a) was very well answered, though a minority of candidates drew ammoniods and several did not draw leaves that were clear. A very small minority created different scales or different-sized boxes and so lost marks.

(b) Part b) was intermittently answered and often muddled. Some students had incorrect measurements whilst others divided 2/5

Q.4 The question was generally well answered (with a mean performance of 3.2 out of 4 marks), with most candidates able to identify the mineral. A significant minority incorrectly chose streak as a property and this highlights the need for candidates to choose a diagnostic property to help in identifying the mineral.

Q.5 **(a)** Part (a) was generally well answered with scales and random orientations well produced. Needle like shapes were less clear and proved problematic for many.

(b) Part b) was less well answered with students often identifying metamorphism but not that it was contact. Very few candidates were able to discuss the importance of chiastolite in explaining that a metamorphic event had occurred, and this did limit the mark candidates could achieve.

(c) Part (c) is a new component to the AS level and therefore relatively new to teachers and candidates. The planning and implementing of a field study are part of the fieldwork skills and some students were able to give a strong and suitable account of how to conduct a transect and used the diagram well. Weaker answers did not make use of the diagram and instead explained what they would expect the results of the investigation to show. This was not required and meant time was lost.

Q.6 **(a)** Part (a) provided a wide range in the quality of responses, but the naming of both fault types did prove particularly difficult for the candidates. There was a mixed response to the question concerning the relative motion of the fault, but most were able to estimate a suitable angle for the fault.

(b) Part b) was a challenge for many candidates but those who were most successful had clearly made notes and/or annotated the statements to break down the cross-cutting relationship information. In many successful answers a process of elimination had taken place.

Q.7 There was a considerable range with regards to the quality of answers produced by different centres, and again there were some centres having many of their candidates achieving double figures and others having very few candidates scoring more than ten marks.

The most common errors included not having the boundaries of B-C and B-A in the correct places underneath the unconformities, faults F1 and F2 dipping in the incorrect directions and cross-sections not showing cross-cutting relationships above the surface. There was also a considerable minority not using rulers and it should be recommended to candidates that they ensure beds are plotted as accurately as possible. There are resources on the exam board website that centres can access for help in teaching this aspect of the specification.

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 i.e. in Q1b where candidates clearly noted that ‘there was one rate of cooling as all the crystal sizes are similar and crystal sizes are large (over 3mm) so formed deep underground’ rather than briefly stating ‘all same size and all large’.

- Traditional topics and subject matter were very well addressed but teachers need to ensure that all new topics are also as familiar to students. In particular Q5c highlighted the fieldwork approach and sampling as areas that need improvement.

- Mapwork was generally well attempted but the correct drawing of faults and geometry (placement of angled beds) were less well developed and require further exploration.

GEOLOGY

GCE AS

Summer 2019

COMPONENT 2: FOUNDATION GEOLOGY

General Comments

Overall the paper was answered well by candidates and was able to differentiate well with a good range of marks. Very few questions throughout the paper were left blank showing a good level of accessibility. There were several questions on the new material from the reformed AS specification which were completed with varying success rates. This was highlighted by questions 5 and 6 in which the mean marks were 42.3% and 36.8% respectively. Focus on these will hopefully help centres to prepare candidates for these topics in future

Comments on individual questions/sections

Q.1 Mean Mark – 7.1/14 Facility Factor 50.8

(a) The vast majority of candidates were able to identify the fossils as trilobites

(b) **(i)** The vast majority of pupils were able to identify feature x as the eyes, although some did confuse this with the cephalon.

(ii) Most pupils were able to identify 2 differences between the eyes of the two trilobites. Where some candidates tripped up was interpreting the eyes as opposed to describing differences. Most successful answers looked at the differences in size between the two and either the shape or position of the eyes on the two trilobites. If the eyes were misidentified the error was not carried forward to this question.

(iii) This question was quite polarising, candidates either scored highly or not at all.
Fossil W – Many candidates referred to the spines as legs when interpreting the benthonic mode of life. The most successful candidates referred to the positioning of the eyes, spines and body shape to infer benthonic and photic zone modes of life.
Fossil Y – Many candidates mistook this trilobite for a burrower due to its small size, or suggested that it was planktonic due to a lack of legs. The most successful candidate referred to the size of its eyes, streamlined body and enlarged glabella to confirm it was a pelagic trilobite.

(c) This question was answered well, most candidates obtained full marks stating marine and low energy as the environment of deposition, while marks were also available for anaerobic conditions. Those who fared less well focussed on the fact that it was a black shale and made comments about organic content.

(d) This question was generally not answered well by candidates, with many focussing on the trilobites rather than the fossil record itself. Successful candidates realised the question was more general and described the problems with the fossil record, incomplete, bias etc.

Q.2 Mean Mark 7.5/14 Facility Factor 53.6

(a) The vast majority of candidates were able to identify the fossil as a coral.

(b) **(i)** Many pupils realised that fact that there was a coral in the limestone was a clear indicator of the palaeoenvironment. However, many failed to link this to modern corals and uniformitarianism to gain full marks.

(ii) This question was generally answered well using the principle of superposition to confirm the red beds/red sandstone as the youngest bed. Some candidates failed to achieve top marks as they did not use the way-up criteria to confirm that the beds were not over turned.

(c) The first of the QER questions was accessed by most, however, candidates who did not attain the higher mark bands failed to use all the available data given in the question. To achieve the top band candidates were required to discuss multiple sources of data including fossil content, rock texture, sedimentary structures and the unconformity. The most successful candidates methodically worked through all the beds, beginning with the limestone. Many candidates mistook the limestone for a low energy environment due to it containing fossils. However, in the figure it states that the fossils were fragmented, whilst some corals live today in high energy environments. A lot of students did not recognise that there was an unconformity present which required a period of high energy and erosion.

Q.3 Mean Mark 8.5/18 Facility Factor 47.3

(a) **(i)** In this question candidates were required to identify the type of deformation taking place at each section of the graph based on Hooke's law. Many pupils were unable to do so to obtain 3 marks and instead responses were focussed on the geological deformation, such as faulting and folding.

(ii) This question was generally not answered well by candidates, as they failed to talk about deformation, instead discussing the differences in lines P and Q regarding stress and strain. The most successful candidates referred to the yield points, zones of plastic deformation and the fact that line Q does not have a fracture point.

(iii) Like the previous question, this was generally not answered well. Candidates failed to discuss the type of change in temperature (increase or decrease) or failed to discuss actual deformation. Successful candidates stated that an increase in temperature causes rocks to become more plastic or ductile.

(b) **(i)** This question was accessed well by most realising that folding is a type of plastic deformation (e) and faulting was brittle (f). Interestingly despite getting this question correct many candidates did not link this well to figure 3a and failed to obtain the marks here.

Application of Hooke's law is good, knowledge of the graph and specific terms looks less secure.

(ii) This question was accessed by most, although those who failed to achieve full marks did not discuss the deformation. Instead they wrote about the time taken for the beds to form. Most successful candidates approached the question in terms of cross-cutting relationships, noticing that the fault cut across the fold.

(c) **(i)** Few candidates achieved full marks in this question. S was generally identified by those with secure knowledge as a limb whereas many pupils identified T as the axial plane which is a two-dimensional surface. The line of the axial plane on the surface is the axial planar trace. Credit was awarded for hinge.

(ii) There was a lot of margin for error in this question and most candidates were able to measure the required distances and use the formula provided. Where candidates fell short was failing to round correctly to three significant figures. Generally, this question was answered well.

(d) Most candidates recognised that the fault was not a normal fault, correctly identifying it as a reverse fault with a valid reason. Some candidates did not give enough detail in agreeing with the statement in terms of crustal shortening, with reference to the reverse fault or folding as evidence.

Q.4 Mean Mark 5.5/15 Facility Factor 36.9

(a) **(i)** The majority of candidates failed to achieve full marks on this question as they used all the suggested terms in the question (basaltic, andesitic and silicic) in their response when only two out of the three were necessary. The most successful candidates realised that basaltic lava would be erupted from both locations A and C.

(ii) Candidates here generally failed to interpret the question correctly, most discussed how magma made its way to the surface and not how it was actually generated. Some confusion/misconception was evident with some pupils referring to the mantle as already in a molten state. Successful candidates correctly discussed a reduction in pressure due to thinning of the lithosphere and partial melting of the mantle as contributors to the formation of a mafic magma.

(b) **(i)** The vast majority of pupils realised that the pillow lavas must have been erupted into water to form and so would be at locations A or C. Only those who misidentified the pillows selected location B.

(ii) This question was generally answered well with most gaining two marks. Where candidates failed to obtain full marks they did not give sufficient detail for a three mark question. Most stated they formed underwater and cooled quickly but failed to give further details for the final mark, such as a glassy texture or describing the formation of the tear drop/sag structure.

(c) In this the second QER question, the focus was the composition of the magma and how that led to hazards and so candidates who just described hazards were unsuccessful. In order to gain access to the higher-level mark bands candidates were required to discuss multiple magma characteristics (viscosity, gas content and temperature). If these were then linked well to multiple hazards then access to the top marking band was granted. Most focussed on andesitic magmas with higher viscosity and gas contents, and linked to explosive eruptions, pyroclastic flows and ash effectively. However, basaltic magmas with low viscosity and gas content were linked with lava flows, gas emissions and ash equally effectively, although this was a less popular option.

Q.5 Mean Mark 6.3/15 Facility Factor 42.3

(a) Candidates were required to draw an axial plane trace of either a syncline or anticline. A common error was drawing the synclinal axial plane trace in the position of the anticline (in the white bed).

(b) The common error on this question was failing to give sufficient detail for the marks available. The vast majority of candidates identified the igneous body as dyke as it was discordant, but failed to comment on the linear nature of the body for the final mark.

(c) A disappointing number of candidates drew a clastic texture here containing grains rather than crystals. A common mistake was that candidates did not draw enough phenocrysts. For a rock to be considered porphyritic it needs to have 25% phenocrysts which are generally more euhedral than the groundmass. The phenocrysts were generally drawn to an acceptable scale, however, the groundmass was often drawn too small.

(d) **(i)** This question was probably one of the toughest on the paper, reflected in the marks awarded. A younger igneous body should have an isochron of shallower gradient and therefore a correct answer would have a straight line drawn below that of igneous body K. A large number of candidates plotted J on the line already drawn and showed a lack of understanding of what an isochron was. There were three marks available for the reasons given, successful candidates realised that J was younger than K due to its cross-cutting relationship and then explained this in terms of the time required for the Sm parent isotope to decay into the Nd daughter isotope.

(ii) The most successful candidates here realised that this question was a matter of ratios, not patterns. Many pupils continued counting the decrease from 5-2 for the 143Nd line, which lead to confusion for the 144Nd answer. The key was identifying the 1:3 ratio given in the orthopyroxene column.

Q.6 Mean Mark 5.2/14 Facility Factor 36.8

(a) **(i)** In a similar way to question 3cii this question was generally accessed well by candidates. However, common errors were a misunderstanding of three significant figures and the method for calculating percentage change.

(ii) This question threw up a number of misconceptions. A large number of candidates incorrectly referred to the asthenosphere as semi-molten or partially molten. The asthenosphere is a solid layer of the mantle which is less rigid and less incompressible. Candidates did not refer to the fact that it is close to its melting point to explain why it is less rigid/incompressible.

(b) In this question a number of misconceptions were evident regarding the state of the asthenosphere. It is able to flow, however, it is not molten or partially molten. The key is that it is a solid with the ability to move (ductile) which allows the lithospheric plates to move above it.

(c) **(i)** Candidates who failed to score sufficient marks on this question relied too much on their assumed knowledge rather than the data provided in the figure. Where many candidates missed out was identifying the importance of the eclogitic facies, this is where the plate becomes denser than the mantle and in an important factor to explain why a subducting plate continues to descend into the mantle. Many candidates correctly explained that the oceanic plate subducts due to its increased density and pulls the rest of the plate with it.

(ii) This question again highlighted some misconceptions as the majority of candidates suggested convection currents for another method of plate movement without referring to the drag force that a convecting mantle would have to apply to the base of the plate. Successful candidates discussed ridge push as a factor with new material being created at the ridge pushing older material to the side. Few candidates achieved three marks due to giving insufficient detail for a three-mark question.

Summary of key points

- Candidates should ensure that sufficient detail is given to answers to warrant the marks available.
- For QER questions candidates need to include multiple sources of information and a variety of pieces of evidence or factors to give them the best chance of hitting the higher mark bands.
- Candidates need to be aware that the asthenosphere is not partially molten. If this were the case volcanoes would not be focussed on plate boundaries and at mantle plumes. A partial melt is only generated when there is a change to the normal state through decompressional partial melting, dehydrational partial melting or where a mantle plume is present.
- For calculation questions, candidates should ensure that all working methods are shown as errors are carried forward and if a mistake has been made at the initial stage there are still marks available for the correct working method and the ability to give an answer to the correct number of significant figures.

WJEC
245 Western Avenue
Cardiff CF5 2YX
Tel No 029 2026 5000
Fax 029 2057 5994
E-mail: exams@wjec.co.uk
website: www.wjec.co.uk