



GCSE EXAMINERS' REPORTS

GEOLOGY

SUMMER 2017

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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.

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ON-SCREEN EXAMINATION

The on-screen examination ran very smoothly with virtually all centres being able to complete on-screen as intended. Feedback from centres suggested that the candidates enjoyed the experience, especially the quality of the diagrams and style of questioning and found the examination paper a fair but challenging test.

It is pleasing to report another successful year for centres and that the cohort included some exceptional candidates. The candidates coped well with some difficult questions. The ability of the candidates seemed similar to that of last year. Candidates at the lower end of the ability range showed positive achievement and almost all gained a reasonable number of marks on each question.

General Advice

Questions should be read carefully and in particular the scales on the axes of graphs e.g. Figures 1, 15 and 18 and the scales on diagrams e.g. Figures 7, 8 and 17. It was evident that candidates found the extended writing more challenging than the other styles of questioning. Poor grammar often detracted from the clarity of the answer and this was taken into account in Section 4 Q7 and Section 5 Q5. Candidates should be encouraged not to rush through multiple choice questions as everyone should be able to complete the examination well within the time limit.

As the majority of the paper is now machine marked it is not possible to make detailed comments about every question and the report will concentrate on those questions which were marked by examiners. Sections 2 and 3 proved to be the most challenging whilst candidates generally did well on Sections 1, 6 and 7.

Section 1

This was a question which tested the ability of candidates to interpret a graph relating sea level to climate change and CO₂ content of the atmosphere during the Quaternary, knowledge of the albedo effect and landscape evidence for changes in sea level. Some candidates incorrectly thought that melting of ice sheets generated enough CO₂ to affect climate change and had little knowledge of the albedo effect (Q2). However there were many good answers. Most candidates identified a rise in sea level from Figure 2 (Q3 and Q4) and could describe the evidence. Others tried to see raised beaches in Figure 2 with consequently incorrect conclusions on a decreasing sea level.

Section 2

This question included photographs of folds and minerals, a geological map and possible sites for carbon capture. Candidates could describe the folding in Figure 3 (Q1) but had more difficulty interpreting the folding on the map (Q2). Assigning the stress to the type of faulting was also a challenge which many failed. Responses to the mineral questions were better (Q4 and 5) although all of the options for the methods of mineral exploration attracted some candidates. There was insufficient detail in many of the answers in response to the potential site for carbon capture. The impermeable nature of the cap rock was the best known property but the high porosity and high permeability of the reservoir rock was not always described. Even more vague was the description of the trapping mechanism (anticline) or other possible oil and gas traps. Too many candidates appeared to think that oil and gas is stored in a big hole in the ground rather than in pore spaces. There was reference by some candidates to the advantages of an existing infrastructure. Most candidates gained some marks on this question.

Section 3

This was a question which required the identification of sedimentary structures, description of sedimentary rock textures and interpretation of the environment of deposition using the evidence obtained. A question on springs and rock lithification followed. The question was generally well done. Most candidates identified the structure in Figure 7 (Q1) and the texture of the rock in Figure 8 (Q2). The processes of attrition and abrasion were often confused (Q3) and there was only an occasional reference to wind transport. Many candidates incorrectly thought the large scale cross bedding was a product of water transport (Q4) rather than a dune environment. There were also vague references to 'warm', 'hot' or 'dry' climates and a latitude 'on the equator' or 'tropical' instead of being more precise about a desert latitude (between 10° and 30° north and south of the equator). Whilst the impermeable nature of the shale was commonly known as a cause of the spring location (Q6), few referred to the permeability of the sandstone aquifer as a requirement and even fewer could explain the precise location of the spring as being related to the position of the water table, the contact between the aquifer and the shale or the saturation of the aquifer.

Section 4

A typical plate tectonics question which involved several types of plate margin and the characteristic seismic and volcanic activity at each. This was followed by questions on the volcanic hazards posed by the Soufriere Hills volcano and methods of prediction and risks involved. The question was generally well done. There was some repetition of the question (Q7) i.e. 'ground deformation' and 'gas emission' as being used for prediction. Whilst candidates generally knew the instrumentation involved in measuring ground deformation, the same was not true of gas emissions. Some candidates described seismic evidence and temperature changes which were not asked for in the question. Candidates could describe two reasons for the reduction in risk in areas of high economic development without any problem (Q8).

Section 5

This was a fossil and dating question. A large number of candidates incorrectly identified the three-stiped graptolite as having three lobes (Q1). The vast majority of candidates incorrectly stated that fossil N was the most suitable for dating the strata in Figure 14 (Q3). The most frequent answer given was that it was the most abundant or the most common. Few candidates identified the correct answer which was fossil P and even fewer came up with two valid reasons. Most could say that it was present in all three locations but not add that it had a narrow time range or was facies (rock) independent. Credit was given for the incorrect fossil provided the reasons were logical and fitted the distribution in Figure 14. Q5 was probably the poorest answered on the paper. Most candidates did not get that radiometric dating of igneous rocks is more reliable than that of sedimentary or metamorphic. There were some good answers around the suitability of half-lives e.g. carbon dating. There were a lot of vague answers about rocks being non-radioactive. Q6 posed no problems with candidates very familiar with some of the main stages in the evolution of life.

Section 6

A wide ranging question based on the interpretation of a geological map and some of the rock types exposed. A growing number of candidates have difficulties with geological maps and cross sections – skills which were once second nature to candidates and thoroughly understood in previous specifications at GCSE. Map-work is still an important part of the current specification. Obviously cross sections cannot be constructed by candidates on screen but the interpretation of maps and cross sections are important geological skills which need to be assessed. The texture and mineralogy of the gabbro were generally correct (Q1-3). The variation in crystal size was accurately described using values (Q4) and the reasons given usually involved reference to the chilled margin. The geological history of the map was poorly done (Q6) with candidates taking no notice of the dip direction to work out the order of the sediments and placing the sill in the wrong position. In fact the only mark often awarded was the position of intrusion S. The origin of alignment of the micas in Figure 19 (Q8) sometimes

generated two marks for 'heat and pressure' and 'regional metamorphism' but the third mark was more elusive. Some candidates ignored the importance of heat in developing the crystalline structure. Few candidates described the schistosity as orientated at right angles to pressure or due to recrystallization. A few perceptive candidates described the bending of the micas around the more resistant garnet.

Section 7

This question involved an interpretation of data on sources of electricity generation in the UK, the location of offshore windfarms around the UK and general questions about renewable and nuclear energy. The interpretation of Figures 20 and 21 (Q1-3) caused no problem for candidates. Candidates could also provide two reasons for the increasing importance of renewable energy (Q4). Answers to the problems caused by nuclear waste and possible geological solutions (Q5) were often vague such as 'causes harm to the environment' and 'causes death'. Better answers described the long lasting effects of radiation. Likewise proposed geological solutions did not get much further than 'burial' in many cases without stipulating some of the possible additional requirements such as geological stability and impermeable strata. There were several misconceptions here about burying nuclear waste in oil and gas traps and burying it at sea.

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CONTROLLED INTERNAL ASSESSMENT

WJEC and the Moderators recognise the effort and enthusiasm that geology teachers invest in their candidates, which certainly shines through in the quality of work that they produce. Forty centres submitted coursework for moderation which is a reduction on previous years.

Administration

The administration and moderation of the coursework samples ran smoothly once again this year. The Moderators are very grateful for the efficient organisation and punctuality of the majority of centres. The system of task accreditation assisted centres by highlighting possible problems at an early stage. There is quite a turnover of centres with centres dropping in and out as the years go by and new centres taking up the subject – sometimes for only one year. There is a continuous requirement on the part of Moderators to ensure, as far as possible, that the work is of similar standard across the board and from year to year and the tasks undertaken by candidates fit the requirements of the specification.

A small number of centres did not complete a Task Accreditation Form (Option 2) for 2017. All centres should ensure that this form is submitted at least one month before the fieldwork for the 2018 assessment is to be carried out.

Points which can be emphasised as a result of this year's submission include:

- Please **enclose a copy of Task Accreditation Form** for Option 2 when the sample is sent to Moderators. This greatly assists the Moderator in comparing samples;
- Where a Centre has some candidates who have completed Option 1 and others Option 2, this should be made clear on the GL2 form. Both options should be included in the moderation sample, even though this may require additional candidates' work being added;
- Mark totals should be double-checked and great care taken to ensure that these are correctly entered into the electronic mark input system.

Packaging Coursework

When packing the coursework samples, please try to reduce bulk and weight as much as possible. A4 hardback ring binders should not be used. It is helpful (and cheaper for centres) to use slim plastic folders that can be packed efficiently. The use of large and heavy field notebooks containing only a few pages of assessed material is to be discouraged. Please consider detaching or photocopying the relevant pages of field notes and attaching them to the front of the report e.g. with a treasury tag. Please label coursework notebooks with candidates' name and centre number as notebooks are sometimes separated from reports in the post.

Option 1 Virtual Fieldwork

Centres should be aware that Option 1 narrows candidates' experiences and opportunities and this can manifest itself both in the internal assessment and the examination. Candidates attempting Option 1 often have difficulty with the evaluation and planning because of their lack of field experience. Attempting Option 1 should not be a replacement for fieldwork. Candidates who are absent for Option 2 should complete Option 1.

Candidates handled the data efficiently and logically and demonstrated some geological skills well. The observations in the field notes were accurate in the main and clearly recorded, particularly the specimen descriptions. However, one or two centres had no distinguishable field notes or merely annotated the photographs without drawing field sketches. It is difficult for candidates to demonstrate any individuality with this option.

Marks awarded were sometimes on the generous side and it was felt that in order to justify the higher marks, candidates should have included most of the following:

Field notes

- location 1 labelled sketch of graptolite *Didymograptus*
- locality 2 hydrothermal vein in limestone - description of haematite specimen B
- photograph 2 labelled field sketch of unconformity location 3
- graphic log photograph 2
- measurement of dip angles of lower beds at location 3
- photograph 3 labelled field sketch of faulting location 4
- a graphic log each side of the fault of location 4 but unlikely
- location 5 description of conglomerate specimen C
- photo 4 labelled field sketch of columnar jointing location 6
- description of specimen D quartz-feldspar-porphyry location 6
- description of specimen E slate location 7
- location 8 measurement of orientation of dykes inserted in table 1

Report

- annotated photographs
- maybe a graphic log of location 3/4 but unlikely
- unconformity history
- faulting –normal approx. 1m throw
- lava flow/columnar jointing/porphyritic texture – two rates of cooling
- regional metamorphism to form slate
- location 8 rose diagram of dykes in table 1
- interpretation of location 8 rose diagram of dykes
- mineralisation
- cross section of map
- **conclusion** interpretation of changing **geological environments** from fossils/rocks/data
 mudstone
 graptolite *Didymograptus* shale fine grained low energy/age
 limestone shallow tropical
 red sandstone desert?
 coarse sandstone/ conglomerate transgressional marine
 breccia with regional metamorphic clasts wadi?
 igneous history dykes (trend) and lava flow
- **geological history** table summary – deposition mudstone shale limestone red sandstone
 folding
 dyke
 uplift erosion unconformity
 deposition sandstone conglomerate breccia lava flow breccia
 faulting when?
 tilting marine erosion

Option 2 Actual Fieldwork

There were some excellent field investigations seen, which are being perfected by the centres and well suited to the specification. The best investigations allowed the candidates to demonstrate essential field skills (such as rock descriptions, field sketching, fossil identification, dip and strike measurement and sedimentary logging) and perform suitable analytical techniques on the data collected. It is good to see geological field skills being demonstrated with a high degree of competence. The work produced by the best candidates would be a credit to students at a higher level and centres are congratulated on the continuing quality of work submitted by their candidates.

A mixture of field tasks was undertaken with a rough break down being investigations into:

- interpretation of sedimentary environments
- mapping exercises leading to geological sections and history
- structural analysis such as orientation of strike of folds, assessment of the degree of crustal shortening and joint analysis
- fossil counts and orientation
- clast analysis of pebble beds and interpretation of environment
- orientation and origin of igneous structures

Centres are to be congratulated on the variety of opportunities given to candidates in areas of outstanding geology such as Purbeck, Lulworth, Osmington (Dorset), Walton on the Naze, Shap, Peak District, Wirral, Bude, Budleigh Salterton, Arran, Ogmere, Crookdale Crag (A6 Shap), Broad Haven (Pembrokeshire), Marloes Sands (Pembrokeshire), West Angle Bay (Pembrokeshire), Black Mountains, Ballycastle (Northern Ireland), Woolhope, Buchan Coast (Scotland), Kentmere Valley, Forest of Dean, Kimmeridge Bay, Swanage, Durdle Door, Isle of Wight and Barry. Other centres used a variety of local geological locations.

However centres need to take note of the following as a result of this and previous years' submission;

1. Some candidates had little or no data in the field notes yet were able to produce lots of data in a report.
2. In a number of cases, opportunities for the collection of basic field data have been missed. Observations such as rock identification, grain size, sorting, direction of cross-bedding, clast roundness/orientation, field sketches, dip and strike measurements and sedimentary logs should normally be part of every investigation (where appropriate).
3. Some thought has to be given at the data collection stage as to whether the form of the data being collected is suitable for processing and analysis, e.g. histograms, cross-sections, logs, rose diagrams, maps and geological histories.
4. There is no need for candidates to repeat observations made in the field notebook within a report unless it contributes significantly to the analysis. It is more advantageous for candidates to concentrate their efforts on the analysis and evaluation.
5. It is strongly recommended that candidates practise field sketching from photographs or slides prior to fieldwork being carried out. The field notes provide the basis for the report and should be considered an important part of the investigation.

6. Evaluation is a difficult skill which requires more attention within the teaching scheme. The emphasis of this skill has now changed to an evaluation of the methods of data collection, which includes an awareness of the accuracy of the equipment and methods used for making the measurements. Evaluation is not a list of excuses. Simplistic statements regarding lack of time and bad weather do not form the basis of an evaluation with any merit.
7. Presentation of work was generally good and many centres have found a suitable way to allow candidates to use ICT in the production of their reports without them being able to access their work outside the classroom. This will not be possible for all centres and well-presented hand-written work is perfectly acceptable – however the hand writing must be legible. Quality rather than quantity is to be encouraged. The reports should be concise, relevant and clearly focused. Please dissuade students from including large amounts of photocopied material from secondary sources.
8. Some centres did not heed the advice given in previous Moderators' Reports.
9. Centres using tuition at Field Studies Centres should make sure that centre staff are fully conversant with the assessment criteria and regulations for report writing.
10. When constructing rose diagrams of 'dip' candidates should make it clear as to whether the diagram is of dip direction or strike direction (in which case strike direction and plus 180° should be shown). Dip angle is not usefully displayed on a rose diagram.

Assessment

Many centres are to be congratulated on the accuracy of their assessment so that the need for scaling is now manageable and more accurate although there were unfortunately some examples of very generous marking. There are three main reasons why scaling has to be applied.

- Awarding of marks on inappropriate tasks e.g. lack of focus for the investigation or lack of opportunity for the candidates to collect suitable data. Advice is given to centres at the Task Accreditation stage.
- Reliable rank order but marks generous or severe. This can be rectified by scaling but scaling is a crude instrument and can be disadvantageous to some candidates. Centres need to be certain that there is written evidence for the marks awarded.
- Failure to recognise that candidates have not met some aspect of the assessment criteria, e.g. not planning an extension to an investigation already carried out or completing an evaluation. This can be avoided by careful reading of the specification. Any aspect of the criteria not completed should be given zero.

Support

Centres should be aware that there is help available from the WJEC. Published exemplars of coursework investigations are available on the WJEC website. Moderators' Reports on the current moderation process are sent out to centres. Centres are urged to act on any recommendations in the Moderators' Reports. The Moderators do not enjoy moderating work which achieves low marks as this is going to be disappointing for the centre and the candidates, especially when there is often so much suitable geology on the centre's doorstep, which, with a little help and guidance can result in a successful submission.

The fieldwork proposal for Option 2 should be submitted to the subject officer David Evans (david.evans@wjec.co.uk) at WJEC at least one month before undertaking the field work. Details of the specification can be downloaded from the WJEC website where the appropriate forms and guidance for teachers can also be found. For further support contact David Evans or Sophie Gibbs the subject support officer at WJEC (sophie.gibbs@wjec.co.uk).



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