WJEC
CBAC

GCE EXAMINERS' REPORTS

GEOLOGY
AS/Advanced

SUMMER 2010

Statistical Information

This booklet contains summary details for each unit: number entered; maximum mark available; mean mark achieved; grade ranges. *N.B. These refer to 'raw marks' used in the initial assessment, rather than to the uniform marks reported when results are issued.*

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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GEOLOGY

General Certificate of Education

Summer 2010

Advanced Subsidiary/Advanced

Principal Examiner: Mr David Evans

Unit Statistics

The following statistics include all candidates entered for the unit, whether or not they 'cashed in' for an award. The attention of centres is drawn to the fact that the statistics listed should be viewed strictly within the context of this unit and that differences will undoubtedly occur between one year and the next and also between subjects in the same year.

Unit	Entry	Max Mark	Mean Mark
GL1	1433	60	30.7

Grade Ranges

A	40
B	34
C	29
D	24
E	19

N.B. The marks given above are raw marks and not uniform marks.

GL1

Once again the GL1 examination was designed to test a wide range of skills including the interpretation of diagrams, a graph, geological cross-sections and a geological map. The paper covered many areas of the specification content and included both straightforward and more complex ideas, making it accessible to a wide ability range. Question 4 proved to be the highest scoring of the four questions. Other questions proved to be quite testing in places.

Q.1 (a) The aim of the question was to test the ability of the candidates to simply describe what they see, so that reference to cross cutting, trough-shaped and use of the scale was all credited. Many candidates noted the unconformable nature of the boundary.

(b) This question was well answered with most candidates commenting on the size, shape and sorting of the clasts with the best making use of the scale. The relatively rounded nature of the clasts meant the naming of rock **B** as conglomerate was easily undertaken by most.

(c) The majority of candidates were able to recall that feature **D** is a septum. Fewer candidates noted that the coral of marine origin (according to the principle of uniformitarianism) could not have been originally preserved in a desert and therefore has to be a derived fossil eroded out of pre-existing rock and subsequently incorporated into the conglomerate. Weaker candidates noted incorrectly that the sea must simply have evaporated and turned into a desert.

(d) The majority of candidates understood the nature of a death assemblage as experiencing transport after death, although a number of errors were noted including “died as it lived”. In section (ii) many candidates correctly suggested that the plants were preserved in life position since their roots are pointing down as they would have been in life. A significant number of candidates referred to the fossil coral in this answer which was irrelevant.

(e) In this section students should have made use of many “clues” such as the terrestrial plant fossils and the non-marine origin of coal which indicates that the whole of rock sequence **C** is most likely to be of non-marine origin. Therefore, the marine coral is not likely to have come from rock sequence **C**. Limited credit was given to candidates who suggested that, although unlikely, the sandstones in rock sequence **C** could possibly be marine, and therefore could have contained the coral originally. Limited credit was also given to those candidates who, using age relationships only, noted that the coral could have come from rock sequence **C**, since the coral is now preserved in rock B which is younger than rock sequence **C.**

Q.2 (a) Candidates performed well on this section noting most commonly that the regional metamorphic nature of the rocks meant that the effects of heat and pressure would have destroyed the fossils. Candidates were also able to comment on the relative lack of life in the Precambrian or the fact that fossils might never have been preserved in the first place. Some also wrote about the lack of fossils with hard parts which is beyond the scope of GL1 but was pleasing to see.

(b) The lack of upthrow and downthrow arrows on the fault in Figure 2 meant that candidates had to deduce the age relationships of the rocks on either side of the fault in order to conclude that the hanging wall block was the downthrow side and that the fault was normal. Weaker candidates simply noted the shallow angle of the fault and incorrectly concluded on this basis that it was a thrust fault.

(c) The key to success in this question was noting evidence for both unconformities, one with a difference in dip angle on either side and one without. There was much evidence for the unconformity P–P^1 including the change in dip angle and that the unconformity cuts off the fault and the beds beneath. The only evidence for the unconformity Q-Q^1 related to the age gap between Cambrian and Carboniferous which was noted by the better candidates only.

(d) This was supposed to be a straightforward test of understanding of the cause of well-rounding and sorting by wind and was competently undertaken by many who recognised the effects of abrasion and attrition in air, and the selective nature of air in transporting varied grain sizes. A few candidates incorrectly wrote about current bedding in this section.

In section (iii) examiners were looking for three essential aspects of which the first was that candidates could accurately draw cross bedding. The most common errors here were to either draw it too steep or convex upwards. The second aspect was a knowledge of scale for aeolian cross bedding and the third was that winds blowing from the North would produce cross bedding dipping down to the South. Relatively few candidates gained all three marks.

Q.3 (a) Most candidates correctly inserted arrows in the three boxes to show divergence at the spreading centre and convergence at the island arc. Fewer candidates correctly labelled the trench with many placing the label incorrectly in the rift valley of the spreading centre.

(b) To gain full marks candidates needed to explain the locations on both the subducting oceanic crust **and** under the volcanoes. Most candidates explained the former in terms of subduction, friction and stress release. The effects of movement of magma beneath the volcanoes was noted by only the better candidates. A few weaker candidates simply described the pattern of earthquake foci and, since they offered no explanation as the question asked, gained no marks.

(c) In this section most candidates correctly named a metamorphic rock formed by regional metamorphism. Weaker candidates named sedimentary or igneous rocks. Most answers to part (ii) noted that regional metamorphism involves the influence of heat and pressure and the better answers linked such conditions to plate convergence at the island arc.

(d) The aim of this question was to test the basic knowledge that partial melting of mafic oceanic crust generates magma of an andesitic composition, and partial melting of mantle generates basaltic lava. The better candidates recognised this and even developed answers to include the effects of contamination and fractional crystallisation. Such sophisticated answers were not needed to gain full marks and all the information needed to gain maximum marks was clearly signposted on Figure 3.

Q.4 This proved to be the question on which candidates were most successful.

(a) In part (i) the correct answer of 60 m was simply read off the graph. In part (ii) candidates had to subtract 60 m from 380 m to calculate that the width of the andalusite zone was 320 m. Both were well answered.

(b) The examiners were looking for evidence that candidates would recognise that a smaller body would heat the rocks at the contact point to the same temperature, but that the rocks further away would be most likely to be heated less. Consequently a line starting at the same point on the y axis, but drawn below the existing line was the answer looked for and most candidates produced this.

(c) The answers to this question often gained three marks with recognition of the interlocking mosaic of randomly orientated crystals being key aspects. The use of the scale and noting that the crystals are all approximately the same size was also creditworthy. Weaker candidates used sedimentary terminology throughout.

(d) In part (i) it was expected that candidates would make use of information contained in section (a) (i) and locate the **X** in shale within the correct distance of the margin of the pluton. This was done well by most candidates. In part (ii) candidates needed to understand and explain that metaquartzite is derived from sandstone and that on the map the source of metamorphism would be most likely to be heat from the lava flow. For full marks candidates needed to recognise that contact metamorphism only occurs beneath a lava flow. Few candidates gained full marks because they did not recognise this final point. The weaker candidates linked metaquartzite to metamorphism of limestone.

GEOLOGY

General Certificate of Education

SUMMER 2010

Advanced Subsidiary/Advanced

Principal Moderator: Mr Craig Wall

Unit Statistics

The following statistics include all candidates entered for the unit, whether or not they 'cashed in' for an award. The attention of centres is drawn to the fact that the statistics listed should be viewed strictly within the context of this unit and that differences will undoubtedly occur between one year and the next and also between subjects in the same year.

Unit	Entry	Max Mark	Mean Mark
GL2a	1385	60	34.9

Grade Ranges

A	42
B	37
C	32
D	28
E	24

N.B. The marks given above are raw marks and not uniform marks.

GL2a

The paper tested the range of skills and techniques flagged up in Unit GL1 of the specification. The demands made by the paper on candidates were designed to be broadly comparable with papers from previous years. It had to be, like GL2b, centre marked with moderation by the WJEC team. A meeting, whose personnel included the moderators, took place two days after the paper was timetabled. The mark scheme proposed by the Principal Moderator was reviewed against some candidates' scripts and a definitive version was then published, downloaded by centres from the WJEC website. Guidance in its application was available, as in the previous year, via e-mail to the Principal Moderator for this unit. The scheme suggested expected, acceptable and unacceptable responses. It stated that alternative acceptable answers could be accepted. The e-mails and the moderation process indicated that this did occur. Feedback from centres, and moderation of sample scripts suggested that the application of the mark scheme by teachers was almost universally successful. There were a small number who failed to apply the mechanics of marking stated on the cover of the mark scheme, and these issues are discussed in their Centre Reports, which are issued alongside publication of results. Of the 94 centres which entered candidates for this paper, 88 were not scaled with the original mark remaining unchanged. Only 5 were deemed too generous and 1 too harsh, and their marks were scaled accordingly. The statistics for the 2010 paper are comparable with those of 2009, and it is concluded that this year's paper performed at a similar level to previous ones.

Q.1 Candidates who used the mineral data sheet usually stated the expected answers in part (a)(i) but a wide range of colour descriptions were credited as alternative acceptable answers. Some candidates penalised themselves by describing a list of colours which included those appearing in the "do not accept" column of the mark scheme. Not all candidates were able to use named physical properties to distinguish between the minerals in (ii), and equally, the concept of scale on a photograph was beyond many in (iii). Marks were awarded for the two statements in (iv) in two ways. Either for writing "false" with one valid reason, or by giving a correct description with one valid reason. The better candidates had little trouble with recognizing the two changes in part (b), but weaker candidates lost one or both marks by simple guesswork.

Q.2 The majority of the specimens were sandstones, although some centres received slightly coarser gritstones/conglomerates. The mark scheme anticipated this and it was applied to part (a) without too much difficulty by centres. Unfortunately, a minority of centres had a range of texture sizes. One centre e-mailed photographs of Specimen B to the moderator to ask for advice. Teachers who raised the textural variation were instructed to mark giving the candidates the benefit of doubt with the answers to (i) determining what to mark in (ii) and the scale mark in (iii). Centre specialists are expected to check the specimens on arrival; they could contact the subject officer if a variation in any one specimen is obvious. Many candidates didn't use the hand lens effectively, producing rather stylised drawings in (iii). Some centres were very generous in crediting the drawings despite the examples contained in the mark scheme. Part (b) was only awarded 4 marks and so candidates gained credit for describing, rather than explaining, the evidence for a fluvial environment. Credit was also given when the evidence was applied to alternative environments – the mark scheme gave details of this approach. This part of the question proved to be a good discriminator.

Q.3 Some excellent drawings were seen, but some candidates penalized themselves in part (a) (i) by careless observation missing the point that the porphyroblasts are random, have good shape and are contained within a fine rock (Map 1 key names the parent rock unit as a shale). Again some centres were too generous. There was enough evidence on Map 1 and within the stem of the question to suggest thermal/contact metamorphism, but weaker candidates still tried to insist that it was regional! The evidence was either textural or mineralogical in (ii). Part (b) saw a wide range of rock types suggested, but whereas many scripts were accurate in describing the crystalline texture, they were not always as good in getting the composition mark. Calcium was not credited here. Part (c) had a mixed response with only a very few candidates gaining all 4 marks. Most candidates realize that dykes are discordant and so scored here, and many also correctly described the medium textured Specimen E as being the wrong texture for a lava flow. The metamorphism at Locality II on Map 1 was at the base of the igneous body so it was a false evaluation as it could indicate either a sill or a lava flow. The alteration at Locality III was above the body, so making it a sill.

Q.4 Part (a) (i) and (ii) produced the usual range of answers with better candidates scoring full marks. It was unfortunate that an erratum was issued for an incorrect spot height on Map 1 which may have had an effect on answers to part (iii). The mark scheme anticipated this and was flexible in order to give credit to the student if they had missed the erratum. Most answers didn't use the borehole data but calculated using the spot heights. The mark scheme clearly stated that it was the western spot height of 750 m that had to be used, as using the eastern one measured the throw on Fault F2 and not F1. This subtlety was wasted on many candidates; it also fooled the markers, who quite often just credited reference to a 750 m spot height! Part (b) saw a mixed response, with many getting the relative order but then failing to position the syncline accurately. Some answers gained partial credit for placing a North-South APT within the bed to the east of Map 2, but this is an anticline and so couldn't score full marks. (iii) required a box to be ticked **and** a correct reason to gain the mark.

Q.5 The very flexible mark scheme traditionally used in questions of this type continues to allow credit to be given for any good interpretation of the information given on Map 1. There are some centres who obviously spend considerable time and effort on mapwork and here candidates' scores on this question are of a much higher standard than the rest of their responses within the paper, as well as that of other centres. It is pleasing to note also that there are now very few candidates who fail to score on this question.

Q.6 The chosen topic this year was how an unconformity provides evidence of a "*hiatus"*- this term is used in the specification. Answers could have been entirely from a candidate's own fieldwork where similar problems have had to be solved, but it also could have been answered using Map 1 and/or Photograph 5. Credit was given for "basics" and then "details" as outlined on the mark scheme. It is disappointing to report that very few candidates gained full credit on this question with most getting half marks or less. More candidates failed to score in this question than in any other on the paper, usually by just ignoring it, yet a very simple sketch e.g. of Photograph 5 with simple labels of horizontal rock above, tilted rock below and the cross-cutting nature of an erosion surface/unconformity would have scored half marks (see mark scheme). Additional marks may have then come from the weathered/uneven nature of the erosion surface, included fragments of the older rock in the younger, etc. A significant number of candidates simply described how a theoretical unconformity formed.

GEOLOGY

General Certificate of Education 2009

Advanced Subsidiary

GL2b Investigative Geology

Principal Moderator: Dr Alan Seago

Unit Statistics

The following statistics include all candidates entered for the unit, whether or not they 'cashed in' for an award. The attention of centres is drawn to the fact that the statistics listed should be viewed strictly within the context of this unit and that differences will undoubtedly occur between one year and the next and also between subjects in the same year.

Unit	Entry	Max Mark	Mean Mark
GL2b	195	60	41.8

Grade Ranges

A	48
B	42
C	36
D	30
E	24

N.B. The marks given above are raw marks and not uniform marks.

GL2b

Eighteen centres submitted field investigations for moderation. It is pleasing to report that centres are taking note of comments made in individual centre reports in previous years so that there is a continuing improvement in the suitability of tasks being undertaken and the quality of candidates' work. There has been a vast reduction in the number of centres where scaling is required and the amount of scaling that has to be applied. There are two main reasons why scaling has to be applied;

- reliable rank order but marks generous or severe
- failure to show how criteria have been achieved by annotation of candidates' work

Centres are not now creating difficulties for themselves and for the moderators by submitting field investigations from outside the context of GL1 skills. Centres should be aware of the required context of the investigation at all times as described in the specifications.
The centres are to be congratulated on;

- the standard of work produced by the candidates
- the opportunities given to the candidates to study geology in such suitable areas
- and in most cases the accuracy of the assessment.

The enthusiasm for geology and expertise of the teaching staff in centres is obvious from the quality and effort put into coursework submissions.

There were one or two examples of errors in administration particularly by new centres such as using the incorrect forms, not doubling the marks to a mark out of 60, discrepancies between marks on the work and on the forms and not authenticating the work of the candidates.

The better investigations include the demonstration of basic field skills such as rock identification and textures, identification of field structures using dip and strike/field sketches, sedimentary logging and fossil identification. The data collected can be manipulated and presented in cartographical or graphical form. Some excellent field investigations are now being seen which are well suited to the assessment framework. It is good to see geological field skills being demonstrated with a high degree of competence. There were however a minority of investigations which would have been more suited to GCSE lacking, as they did, any scope for advanced analytical skills and any degree of complexity.

In some cases there was no risk assessment although the number of instances is decreasing. It was pleasing to see the extensive use of the Planning Tracking sheet. Some thought has to be given at the planning stage as to whether the data being collected is suitable for processing and analysis e.g. histograms, cross-sections, logs, rose diagrams maps and geological histories. A number of centres are now making preliminary visits to sites in order to allow some forward planning by candidates, which often results in better Planning marks. Some candidates devoted insufficient time to the retrieval and evaluation of relevant material from different sources.
Some field notes consisted entirely of tables of data and it would be an improvement to see a variety of data collection including field sketches and rock descriptions etc. 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 should normally be part of every investigation where appropriate. 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. In a minority of cases it was difficult to distinguish between field data and secondary data or individual work and collective work. Centres and candidates should ensure that the nature of the work is clearly identified for moderation. Candidates are making good use of their IT skills.

A mixture of tasks was undertaken, with a rough break down being investigations into;

interpretation of sedimentary environments (sedimentary logs, fossils and rock description)

mapping exercises (leading to drawing up of geological sections and history)

analysis of fossil assemblages

joint orientation related to faulting (rose diagrams and stereonets)

structural analysis (faulting and folding styles related to compression or tension or to specific orogenies)

textures of Quaternary coarse grained sediment

nature and relative age of igneous intrusions

evidence for contact metamorphism around a granite intrusion

interpreting past plate boundaries through analysis of volcanic rocks

Centres are to be congratulated on the variety of opportunities given to candidates in areas of outstanding geology such as, North Wales, Isle of Arran, Pembrokeshire, Ogmore, Styal Mill, Tenerife, Gower Peninsula, Dorset, Black Mountain, Lake District, Staffordshire, Devon and Cornwall. Other centres made good use of suitable local geological locations.

Centres should be aware that there is help available from WJEC. Published exemplars of coursework investigations can be obtained from the Subject Officer and INSET activities are provided. Moderators' reports on the current moderation process are sent out to centres. Centres are urged to act on any recommendations in the Moderator's Report, 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. There are guidelines in the specification such as Planning Aid p62 and suggested investigations p22. Alternatively the centre could discuss suitable investigations with me through email/ telephone as several centres do. This can include advice on the suitability of coursework investigations prior to carrying them out and examination of candidate's draft field investigations. Any centre having a problem with applying the assessment framework should contact WJEC well in advance of the submission date. If a centre requires further clarification of the Moderator's Report or assistance with future presentations please contact me at the following e-mail address as345@tutor.open.ac.uk.

GEOLOGY

General Certificate of Education

Summer 2010

Advanced Subsidiary/Advanced

Principal Examiner: Mr Peter Loader

Unit Statistics

The following statistics include all candidates entered for the unit, whether or not they 'cashed in' for an award. The attention of centres is drawn to the fact that the statistics listed should be viewed strictly within the context of this unit and that differences will undoubtedly occur between one year and the next and also between subjects in the same year.

Unit	Entry	Max Mark	Mean Mark
GL3	1144	50	32.8

Grade Ranges

A	37
B	33
C	29
D	25
E	22

N.B. The marks given above are raw marks and not uniform marks.

Section A

General

Section A was accessible even for the weaker candidates. Question 1 was generally very well done though Question 2 proved to be more demanding.

Q.1 (a) (i) This was generally answered well by those who appreciated the evidence indicated a convergent plate boundary. Many did not and had the arrow towards the west.

(ii) Andesite was commonly correctly identified as the most common magma type. This was usually correctly explained but full marks were only available for those who identified the ***evidence*** in their explanation (island arc, explosive eruption, trench). There were some excellent suggestions such as : "There is subduction of basaltic oceanic crust which contains water and partially melts to form intermediate andesite."

(b) This was well done by the vast majority of candidates whose responses mainly referred to breathing problems, roof collapse and the effect on crops. Surprisingly, fewer mentioned the effect of ash on aircraft engines, despite the recent situation in Iceland.

(c) (i) This was generally answered correctly – most being able to give figures within acceptable ranges.

(ii) A significant number of candidates did not acknowledge that there were equal thicknesses of ash at both localities. Most suggested that wind direction would be a factor, but many had difficulty with an accurate description of which direction this would be.

(d) This was generally well done for those who answered the question directly using the data. A common correct response would be "The pyroclastic deposits are within 15 km of the crater and more to the north and west of the crater. Lahars extend to 60 km from the crater and follow river valleys. Lahars are more fluid based and thus flow further on lower gradients."

Q.2 This question was more of a challenge to some though generally accessible to most. It discriminated well.

(a) (i) This was generally answered well though some put the spring at the surface outlet of the drainage tunnel.

(ii) Most candidates drew a convincing cone of depression but many had it much too close to the surface such that some of the lower workings would have been flooded. Weaker candidates attempted a cone shaped depression associated with the water table pre-pumping and mining.

(iii) Maximum marks for this question were given to those who suggested that the cone shape drawn was related to where extraction exceeds the rate of recharge of the aquifer. This answer was usually restricted to the more able candidate.

(b) (i) Most made good use of the data provided and suggested that the oxidation of pyrite and a rising water table would produce acid mine drainage. As this was a data response question it was surprising more did not achieve full marks.

(ii) This was quite well done although a significant number thought that the limestone was effective because it would absorb, form a barrier to, or filter the acid. Most acceptable responses claimed that the acid would be neutralised by alkaline limestone. A very small proportion even pointed out that limestone was composed of calcium carbonate which is a base. A significant number thought that the pH would decrease as a result of the reaction. A few claimed that calcium is an alkali.

(c) This was generally well done, although many chose to state rather than describe. “Subsidence” was very popular but often with no qualification.

Section B

General

Candidates responses to this section were generally favourable. Questions 3 and 4 were equally popular whilst Question 5 was attempted by only a very small minority. There were some very impressive attempts and a significant improvement in the use of labelled diagrams. Some candidates tended to do well on the more open approach to these questions though not all took advantage to show the extent of their knowledge.

Q.3 (a) The question asked for any **two** monitoring techniques with weaker candidates rarely answering the question directly appearing more concerned with giving case studies that were often irrelevant. The significant error with these responses was the number who chose to describe "hazardous geological events" in more detail than "monitoring techniques." Many covered the former in great detail for which they received little or no credit.

Ground deformation and seismic techniques were by far the most popular choices. There were some excellent descriptions but many were very superficial and simply mentioned tiltmeters or GPS devices without direct reference to how this was used on a named volcano. Weaker scripts were seen that simply described how seismic waves were measured but did not relate this to how they might be used in prediction. The measurement of gas emissions was also very popular and usually well done although there are still many who claim that radon is emitted in great quanitites prior to a volcanic eruption. However, where this was directed to earthquake monitoring, the use of radon was generally very well done. Some went into great detail as to how gas emissions are measured (COSPEC and specimens collected at fumeroles etc). A minority also outlined how radon concentrations might be measured considering the fact that it is radioactive and that it is soluble in water.

In order to obtain full marks for this section, candidates were required to make an evaluation of the success or otherwise of each technique although credit was given for reasoning. There was the whole spectrum of claims for possible effectiveness of techniques, some of which were realistic when related to a real hazardous geological event though some were too general as to gain much credit.

(b) In most cases the response was very good and often better than that for (a). The management and control of volcanic eruptions, tsunamis, landslides and earthquakes was generally very well covered. Some candidates preferred to discuss one hazard in great detail while others outlined two or more. Both approaches were given equal credit though some took the breadth of the question too far with little or no meaningful explanation. For example it was often claimed that “tsunami warnings are useful” but very few gave any indication on what evidence such warnings would be based. Another example is that “variations in ground water level is not always a reliable indication of earthquake activity,” with no suggestion why (e.g. relationship with rainfall.)

Amongst common fanciful ideas is that “bombs” (sometimes nuclear!) are used to reduce stress from active volcanoes and fault lines or that pumping water down the San Andreas Fault is an effective method which is commonly used to de-stress the plate boundary.

Q.4 (a) Responses to this question were often very superficial with only the more able candidates considering porosity, permeability, pore-water pressure, friction, shear strength, mass increase etc. Lithology was particularly poorly understood and often angle of slope and vibration amounted to little more than saying ‘steep angles and vibrations cause mass movement’.

The term liquefaction is often used very loosely. A significant number of candidates followed the incorrect line of argument that rain water may percolate downwards through a permeable rock until it reaches an impermeable layer such as shale. The latter will then become saturated and liquefaction will occur. The effect of pore-water pressure in the process of mass movement is also poorly understood despite being examined in previous years.

(b) This section proved to be better answered and some excellent responses were seen. Case studies, sometimes relating to field observations, scored highly as did many who related their answers to a well annotated diagram(s).

Q.5 Too few candidates opted for this question to allow any helpful conclusions to be drawn though marks were generally creditable.

(a) The effect of civil engineering on coastal processes was inevitably described by reference to a case study including some that have been previously set in this paper as data response questions.

(b) This was generally answered well.

GEOLOGY

General Certificate of Education 2010
Advanced

GL4 Interpreting the Geological Record

Chief Examiner: Mr Peter Loader

Team Leader: Miss Jo Conway

Unit Statistics

The following statistics include all candidates entered for the unit, whether or not they 'cashed in' for an award. The attention of centres is drawn to the fact that the statistics listed should be viewed strictly within the context of this unit and that differences will undoubtedly occur between one year and the next and also between subjects in the same year.

Unit	Entry	Max Mark	Mean Mark
GL4	931	100	56.8

Grade Ranges

A	68
B	61
C	54
D	47
E	40

N.B. The marks given above are raw marks and not uniform marks.

GL4

Questions certainly discriminated between candidates, and a wide range of marks were seen.

The number of entries was similar to last year with slightly more males than females.

Although a new specification, the examiners have kept to a similar style of GL4 as developed in previous years.

Section A assesses areas which candidates usually find very challenging - in depth knowledge on igneous processes in Q1, Q3 is a “traditional” rock deformation question, Q2 tackles new sections of the specification in examining Sepkoski curves and fossil related topics and Q4 looks at climate change in geological time. Item level data revealed Q1 and Q2 were the most accessible questions to candidates and Q4 the least accessible for Section A.
Section B has 4 marks more than in old specification but as in previous years candidates showed they are getting familiar with the style of questioning and reasoning and a good range of answers was seen.

Section A

Q.1 The question focussed on a diagram for different tectonic settings for the generation of magma, linking into graphs for geothermal gradients.

Candidates scored well on this question, with candidates demonstrating good levels of knowledge.

(a) The majority of candidates got this correct.

(b) The majority of candidates got (i) and (ii) correct. The best answers in part (iii) linked the rising convection currents to decompression melting.

(c) The majority of candidates were able to talk about sediments containing sea water being subducted and this lowering the melting temperature.

(d) A wide range of responses was seen here, low level answers made vague reference to fractional crystallisation changing the composition showing superficial use of terms and not describing the process. Excellent answers were also seen using a wide range of specialist terminology.

Q.2 The question focussed on a new section of the specification, examining Sepkoski curves and fossil related topics.

Candidates scored well on this question, often demonstrating good levels of knowledge.

(a) The majority of candidates got this correct. In (iii) some candidates misread relative abundance of Phanerozoic faunas for Palaeozoic and gained little credit. Candidates should be reminded that graph questions can gain credit from quantitative assessments.

(b) (i) Incorrect responses here showed candidates were unfamiliar with the Sepkoski curves, and perhaps thought the graphs were stacked behind each other and overlaid, and led to some very complex calculations. The top line of the graph is the total number of faunal families. In (ii) some excellent use of case studies was seen, the Siberian eruptions corresponding to the end Permian extinction, however often candidates mentioned the Deccan events which correspond to the end Cretaceous event, similarly the Chicxulub meteor event in Mexico. No credit was given for snowball earth mechanisms. Limited credit was given for vague references to "gases" from volcanoes. A small number of candidates employed a "scatter gun" approach to give as many mechanisms as possible in one answer eg. an asteroid hit which caused a tsunami and mass volcanic eruptions and the sea level also rose!

(c) The majority of candidates got (i) correct, although some candidates did not relate the differences to modes of life. Some very good answers were seen in (ii).

Q.3 This question examined the rock deformation part of the specification. As in previous years candidates found this a challenging question.

(a) (i) It was disappointing that after two years studying geology, a number of candidates incorrectly identified the fold as reverse or normal!

(ii) The majority of candidates gained full credit.

(iii) The best answers were succinct in their use of terminology, however terms competent/incompetent and ductile/plastic etc were very rare in some centres. Some candidates still persist in talking about unequal pressure from each side to create the asymmetry in the minor folds of the shale, whilst also confusingly saying the sandstone had undergone equal pressure from each side. This erroneous idea, though apparently supported by some textbooks and internet sites, has been identified by WJEC examiners as an incorrect response. Further detail is outlined in WJEC INSET material available from the Subject Officer for Geology.

(b) The majority of candidates got (i) correct, although a good many candidates struggled with part (ii). The most common incorrect response was to offset the bedding by strike-slip movement which gained no credit.

(c) Examiners were looking to credit evaluative statements which explained the evidence rather than candidates simply rephrasing the question stem or stating yes or no. High level answers discussed reverse faults and folding being products of compression but noticed the different orientation of principal stresses to lead to a conclusion of different event phases. They also saw the cross cutting relationship leading to the dyke being after the folding but were unable to conclude the dyke/fault relationship due to lack of cross cutting evidence. This question discriminated well.

Q.4 The question also focussed on a new section of the specification, examining climate change in geological time. Candidates responded well to the data and scored well on this question, demonstrating good levels of knowledge gained from their studies.

(a) The majority of candidates got (i) correct. The most common response was of a near continuous landmass, with 2 major continental areas separated by a narrow ocean. Candidates found (ii) a little more challenging, though most were able to relate a large landmass at the South Pole, and the coldness being capable of supporting thick glacial ice accumulations. High level responses detailed the restriction of water circulation and the mountain belts affecting atmospheric circulation. In (iii) the majority of candidates were able to discuss dropstones and tillites. A small number erroneously talked about the oxygen 16:18 relationship and erosional features.

(b) This was a really good discriminator . A small minority worked down the graphic log which gained little credit. Some confusion was seen by some candidates in linking current strength to particle size (eg. coarse grained so low energy). A few candidates marked the coal forming position on Fig 4b instead of 4a but the majority gained full credit for a tropical land location close to the sea. Part (iii) was a good discriminator and strong candidates showed some superb answers, some of which could have almost been developed into an essay. Weaker candidates struggled to link ice advances to sea level fall and coal forests forming, then warmer periods where ice melted leading to a rise in sea levels with land flooded and a return to the marine shales, with an overall control by Milankovitch cycles.

Section B

The 1:50,000 solid map extract of New Cumnock was clearly reproduced, accompanied by a cross-section. The erratum on page 14 did not hamper the candidates.

Q.5 This question was generally well done, with many candidates scoring highly.

(a) (i) This was well answered.

(ii) Some poor responses were seen indicating that candidates had not made their own basic dip and strike measurements in the field (terms such as calorimeter, gradient gun), examiners were looking for the dip being at 90° to the strike, and how to find the angle, a clinometer to gain the angle of dip from horizontal etc.

(b) The majority of candidates gained full credit here.

(c) (i) The majority of candidates correctly stated the maximum and minimum widths of the metamorphic aureole and linked into (ii) to explain this.

(ii) A few candidates drew very basic sketch maps which did little to explain the width variation of the aureole, and majority trotted out the standard diagram for good credit.

(iii) Many candidates had obviously done past papers and were able to talk about thermal conductivity of rocks and the impact of wet rocks to gain good credit.

Q.6 This question differentiated well.

(a) Some competent candidates failed to link the evidence from the photograph to the environment of deposition, and examiners were looking for descriptions of the evidence rather than just a recall list of terms. Good answers linked the coarse grain size to high energy, and poor sorting to rapid deposition. Part (ii) had many disappointing responses, mostly linked to folding. Key words were describe and suggest, and many candidates lost credit by not describing the variation in thickness (thinner to the North), and explanations were rare (further from the source/reduction in energy).

(b) The majority gained full credit for completion of the rose diagram. In (ii) correct recognition of the current flowing mainly toward the north and a spread/fan shape between NW-NE of the data was frequently seen. Part (iii) seemed most challenging to many candidates, and the correct answer of East was seen in only the strongest candidates who realised the photograph was taken perpendicular to the flow.

(c) This part was poorly answered in many cases. Examiners were looking for how the fault could control the palaeocurrent direction rather than a rotation of the clasts by the movement of the fault. Good answers did make reference to the fault/scarp, with the Southern Uplands being upthrown and floods descending from the high ground down the fault scarp.

Q.7 Candidates performed well on this question and examiners saw the whole mark range being used. The erratum on page 14 did not hamper the candidates.

(a) The majority of candidates were able to state the rock type and geological feature.

(b) (i) The majority of candidates correctly listed the coal seams.

(ii) A range of responses was seen, correct answers linked the dip to the South and the coal being too young to appear at the site. Candidates were very able to answer (ii) detailing coal splitting, poor exploration techniques, faulting and folding to affect the accuracy of coal reserve estimates.

(c) Disappointingly there were a number of candidates who did not attempt this part of the examination. Examiners saw a very wide range of answers here. At the weaker end of the spectrum, candidates misread environmental and substituted economic, or talked very generally about subsidence for which little credit was given as the question stem reminds candidates that it is an opencast site). Candidates showed a wide range of skills but some gave basic answers which simply regurgitated or listed points without any discussion or assessment eg. “there are faults”. As was the case in previous years examiners saw these as ‘token’ mention of points and gave little credit. This area of the examination is building on the information candidates study for GL3, and with that, there is a development of their level of answering required for A2 level. Higher end candidates gave more evaluative answers and assessed issues (further expansion would have more land take, and this would cause a loss of habitat, or increased noise/dust pollution etc). Many candidates gave mini-essays on the global damage of coal combustion which was not specific but stronger candidates linked the further extraction to more transport issues in the area which gained good credit.

GEOLOGY

General Certificate of Education 2010

Advanced

Principal Examiner: Mr Elliott Hughes

Unit Statistics

The following statistics include all candidates entered for the unit, whether or not they 'cashed in' for an award. The attention of centres is drawn to the fact that the statistics listed should be viewed strictly within the context of this unit and that differences will undoubtedly occur between one year and the next and also between subjects in the same year.

Unit	**Max Mark**
GL5 (all options)	80

Grade Ranges

Option	**01**	**02**	**03**	**04**	**05**	**06**
A	55	57	55	56	54	56
B	48	50	48	49	48	49
C	42	43	42	42	42	42
D	36	36	36	36	36	36
E	30	30	30	30	30	30
Entry	234	127	131	123	209	106
Mean	47.5	43.7	45.8	46.7	46.1	52.8

N.B. The marks given above are raw marks and not uniform marks.

Geology GL5 Units 1 to 4

General comment

All section A questions proved to be very accessible. The essays were very discriminatory with the usual problems of candidates not adhering to the rubric. It is pleasing to report that there was a noticeable improvement in spelling this year. However, there continues to be a problem with the legibility of some scripts. Several candidates had writing that drifted between semi-legible and illegible and it proved very difficult to ensure that these candidate were being given full credit for their responses.

Although there continues to be improvement in this area many candidates are still not making adequate use of diagrams.

Candidates' ability to evaluate continues on an upward trend. The basic aim in the past has been to set questions which were accessible enough to allow the average candidate to score reasonably with descriptions of geological features. The ability to produce adequate explanations would take candidates to a higher grade. To identify, and extend the very best candidates an evaluation is now required and, where possible, the type of evaluation expected has been shown in the published mark schemes. (This was more difficult in Unit 1 Q.2. where evaluations tended to be specific to the field examples used.) Although the weaker candidates inevitably find evaluation difficult it has been very pleasing to see that even some of these can now often provide rudimentary evaluation resulting in an improved grade.

Several questions needed an holistic approach so marks indicated in the mark scheme must be taken in context.

Breadth versus depth was employed by candidates and examiners in many essays. However, care has to be taken with some essays. For example, Unit 1 Q.3 and Unit 3 Q.2 where ALL components of the essays must be addressed at some level if the candidate is to obtain the highest marks.

The use of field locations was reasonable but there was not a significant improvement on previous years. Candidates should be aware that this is a convenient way to improve their marks. Although a grid reference is not expected, "Wales" is not considered to be sufficiently precise but the "Gower Peninsula" for example, is appropriate.

The better candidates continue to make greater use of numerical data in their answers.

Candidates should be encouraged to quote field locations, make quantitative descriptions, and use labelled diagrams whenever possible.

Unit 1 - Quaternary

Q.1 (a) (i) Generally well answered, although many candidates clearly did not originally read the question properly and mentioned the cross-section – only to later realise their mistake and have to use arrows to change the answers round.

(ii) Again, a generally well answered question. Some candidates only mentioned one difference. “U” and “V” shaped valleys were the most common correct responses although many preferred to describe in terms such as “shallower” or “less steep-sided.” Correctly applied, these received credit.

(iii) The reasons given were generally good, with most candidates realising that the difference was due to whether ice or water was the dominant erosive agent. A minority of candidates identified the valleys as a fjord and ria.

(b) (i) Reasonably well answered, although a small number of candidates did not read either the question or the graph properly and described the change from the start of the sea-level curve at ~9000 years. Very few candidates noticed that the trend for Milford Haven was steeper over this interval than Loch Morar. A pleasing number of candidates used the graphs to try and quantify the amount of change.

(ii) Candidates who scored full marks noted that it was melting of continental ice that was the key factor, but others got confused between eustatic and isostatic.

(c) (i) Reasonably well answered, most candidates correctly noted that sea level at MH was rising, while at LM it was falling. Pleasingly, many candidates reported heights measured from the graph. The different scales and the fact that they were reversed between the two graphs led to some confusion. Some candidates also talked of a “return to present-day sea-levels!” Credit was also given to candidates who commented that the change was “steady” or “constant” at LM while it “levelled off” at MH.

(ii) Generally well answered although only a minority of candidates scored full marks. Most got the fact that isostasy was the principal cause but few adequately discussed its interplay with eustatic sea-level changes. Virtually no candidates mentioned the possible effect of an isostatic forebulge at Milford Haven

Q.2 This question was not as well answered as in previous years. This is the type of question in which diagrams are essential as most candidates struggle to adequately describe the patterns without the aid of labelled sketches. A disappointingly sizeable minority of candidates who answered this question wrote essays containing no diagrams. The river drainage part of the question was generally answered much better than the underground part of the question. Some candidates gave excellent examples of the features they were describing, but others just described the features in very general terms. Many still claim that carbonic acid **erodes** limestone; that clays are **non-porous**, and frequently confuse the terms porosity and permeability. On the whole the evaluation part of this question was not particularly well addressed.

Q.3 Overall, reasonably well-answered, with some excellent accounts. Unlike question two most candidates included a good range of diagrams, some of which were excellent. Some candidates focused too much on physical and biological processes as opposed to chemical processes. The most popular choice of limestone was oolitic and some candidates were able to cover all three processes in relation to this one rock type. Most candidates attempted an evaluation, some being excellent. Although the question was about modern marine environments, some candidates did not give any modern examples while some gave exclusively ancient examples.

Q.4 (a) This was the most popular question, but was generally not answered particularly well. Most candidates talked at length in (a) about oxygen isotopes and even then did not adequately explain the processes or the rationale behind the technique. Some stated that it is ^{18}O / ^{16}O "from the oxygen gas in the bubbles" and "in the atmosphere" that is being analysed. Others stated that "when it is hot more ^{16}O is evaporated and less ^{18}O. When it is cold only ^{16}O is evaporated." Another common claim is that "When it gets cold ^{16}O is evaporated and ^{18}O is left behind." Very few candidates suggested that as moisture moved towards polar regions then precipitation of water containing ^{18}O would be more likely to happen at an earlier stage than "^{16}O water" thus leading to precipitation of ^{16}O-rich snow closer to the poles. The analysis of bubbles was often not addressed at all and many who did consider them did not recognise the importance of carbon dioxide which was often ignored completely.

(http://earthobservatory.nasa.gov/Features/Paleoclimatology_OxygenBalance/)
(http://www3.hi.is/~oi/Nemendaritgerdir/Ice%20core%20evidence%20for%20past%20climates%20and%20glaciation.pdf)

(b) Overall a disappointing response to a question that has been answered very well in the past. A significant number did not consider pollen and preferred to restrict themselves to mammals (including humans.) These descriptions tended to be very superficial and amounted to little more than "wooly mammoths have thick fur coats which show that the climate was cold" while "lion and tiger remains show that it was warm." A small but significant number of candidates did not read (or understand) the question properly and talked about fossils (e.g. ammonites and corals) as environmental indicators throughout geological time, not specific to the Quaternary as required by the question. Beetles, which had been growing in popularity, were largely ignored this year. Some candidates gave excellent detailed accounts with specific examples of how pollen can be used to assess palaeoclimate. Evaluation of the evidence was generally reasonable but more often than not amounted to saying (for example with pollen) that "pollen is easily dispersed by the wind leading to possible problems."

Unit 2 - Natural Resources

General

A significant number of candidates squandered marks on Q.1 and Q.2 Of particular concern were the responses to 1(a)(ii), (c)(i) and (c)(ii). Often the loss of marks was not due to a lack of knowledge but non-adherence to the rubric or (in the case of c(i)) very sloppy presentation, which is not acceptable at this level.

Q.1 (a) (i) Generally well answered.

(ii) Not particularly well answered – a substantial minority of candidates erroneously listed porosity and permeability as textural characteristics. Grain size and shape were the most common correct answers followed by sorting and the absence of cement.

(b) (i) Mostly well answered, although some candidates got confused either with the correct units or by putting the equation the wrong way round.

Generally well answered. The depth part of the question had significantly more answers out of the correct range than the temperature part, mostly because candidates did not interpolate the scale correctly.

(c) (i) Reasonably well answered, but at the same time very disappointing. Some candidates failed to score marks as they just scribbled a 'blob' for where the oil would be rather than drawing a horizontal line along its base. A few candidates put the oil on Figure 1d at the top of the salt dome.

(ii) This was a very poorly answered question with very few candidates scoring full marks. This was mostly because many candidates talked about the structure rather than the processes of, and reasons for, "migration". Very few mentioned movement of oil along the fault or bedding planes. Some went into great detail describing the formation of the trap and any reference to migration was purely coincidental.

(iii) Reasonably well answered. An alarming number of candidates proposed storing nuclear waste in these reservoirs. Many mentioned CO_2 storage but quite a few did not expand on this and say why this was important – global warming etc. "For the storage of carbon" was also a common suggestion.

Q.2 This was the most popular essay question. Diagrams were generally well used and this was encouraging to see. In general, however, part (a) was often far too superficial and many failed to **evaluate** in (b). This prevented some candidates with otherwise good answers from scoring higher marks. Among the more popular topics for both (a) and (b) were the extraction of coal, copper and china clay. Case studies were once again very well used in this question.

(a) The better candidates described the extraction in great detail while weaker accounts tended to be very superficial often amounting to little more than (e.g. for deep mined coal) "they dig down to the seam, machines dig the coal out and it is taken to the surface." Thus no detail of how a mine is arranged in terms of the number of shafts, their function, the nature of the coal face, what sorts of machines are used, if any precautions need to be taken, how the coal is transported to the surface etc etc. It was not uncommon to see descriptions such as "longwall mining is where they drill along the coal face."

A significant number of candidates either misread or misunderstood the question and went into detail about how (for example) the coal is formed and/or located.
In the case of china clay post-extraction processing such as flocculation, settling tanks, drying to a powder and even uses were considered (often in some detail).

(b) Again the main problem was with (the lack of) detail. Most candidates mentioned noise and dust but made no attempt to evaluate with reference to case studies. The better candidates considered such things as acid mine drainage (often in impressive detail).

Q.3 This was not a particularly popular question, but those candidates who attempted it did so reasonably well. The most popular answers were on geochemical prospecting and geophysical surveying and diagrams were, for the most part, used to good effect in these answers. Evaluation was generally better for this question than the other Section B questions in this Unit. Those who chose downhole logging and remote sensing generally did not explain the topics as well as those who chose the other two. Electrical surveys were popular as a geophysical technique but it was sometimes claimed that it was useful in the exploration of oil as "oil is a good conductor."

Q.4 This question was not answered by all that many candidates, but there were a higher proportion of excellent answers, than for the other questions, with a good number of the candidates showing a significant 'hint of flair.' Some candidates just talked about igneous processes and did not bring in the rock cycle to their discussions. A few candidates are getting confused between magnetite and chromite. Magnetite, although dense is a **late** crystallising phase (~4% MgO), and rarely forms cumulate layers - it is more likely to be disseminated through the rock whereas chromite is an early (> 12% MgO) high temp fractionating phase and because it is the first phase to crystallise very commonly forms layers at the base of large gabbroic intrusions, e.g. Bushveld – it is a major repository for platinum group elements. It was good to see a few better candidates talk about liquid immiscibility as a means of concentrating sulphides in a magma.

Unit 3 – Evolution of Britain

Q.1 (a) Generally well-answered. The most incorrect answers were for the Age of the Caledonian with wrong answers extending to time periods that were too young and the location of Variscan with some candidates being too general in their descriptions and a surprising number putting "SE (or S) England."

(b) Very well answered with most candidates scoring 2-3 marks. It was pleasing to see some candidates measuring the interlimb angle of the fold.

Generally well answered although some candidates got a bit side-tracked by the Southern Uplands Fault and the fact that it cut the Permo-Triassic rocks.

Reasonably well answered, but some candidates neglected to mention plate collision causing crustal thickening and melting, preferring instead to focus on subduction processes. In this region the granites are predominantly formed by crustal melting processes rather than by subduction.

Generally a well answered question, but a lot of candidates did not refer to the figures and, for example, mention the trend of the fold indicating convergence from SE to NW, or crustal thickening and mountain belt formation (HP-LT metamorphism.) Many did not mention the significance of the Iapetus Suture.

Q.2 This was by far the most popular of the three essays, and there were some outstanding answers. On the other hand, there was a significant number of accounts that covered all of the relevant areas but very superficially. Other candidates got caught up in describing one particular piece of evidence in great detail to the detriment of the other evidence. Limestones were almost ubiquitous for the Carboniferous but coal was often ignored. Corals were most popular for the fossils although ammonites were conspicuous. Examiners allow considerable leeway in essays when it comes to breadth against depth. However, as in this case, where candidates are asked to consider three things (rocks, fossils and palaeomagnetism) it is essential that ALL are considered at some level if the highest marks are to be awarded. Examples and localities were used to good effect in this question, but in general more diagrams would have resulted in higher marks. It tended to be only the better candidates who considered evaporites. Most candidates attempted the evaluation part of this question, some to quite good effect, although a very common claim was that a negative feature of palaeomagnetism is that it can only be used with igneous rocks. Also, in its description many candidates claimed that "the alignment" of the magnetic minerals enabled the latitude to be determined. Very few acknowledged inclination. This was usually best explained with the use of a labelled diagram.

Q.3 This question was answered by relatively few although most were of good quality. Few however mentioned the North Sea in their answer. Had they have done so, it would have made an excellent comparison to the North Atlantic, by way of comparing the volume of magmatism, amount of extension etc. Please note that volcanism in the British Tertiary commenced at ~62Ma but that opening of the North Atlantic did not start until 55Ma and was accompanied by a second phase of voluminous volcanism.

Part (b) was generally not answered as well as part (a) and appeared often to be added on as an afterthought. Evaluation was generally very poor to non-existent. There were however a few excellent discussions. These candidates looked at the difficulty in applying the Law of Uniformitarianism in the case of chalk and, in particular, the difficulty in deciding whether in the Cretaceous, it was a shallow or deep water deposit.

Q.4 A small proportion of candidates attempted this question and answers were generally fairly average with few outstanding essays. Very few candidates attempted any evaluation. Some candidates focussed too much on aeolian sandstones. However, as with Q.3. there were some excellent discussions comparing the similarities and differences between aeolian and fluvial deposits and the difficulties in distinguishing one from the other.

Unit 4 – Lithosphere

Q.1 (a) Reasonably well answered, although it was disappointing that a number of candidates did not appreciate the significance of the normal faults. Many referred to the faulting as "step" or "rift" faulting, both of which were accepted. Many used the "land sediments" as their evidence. This often proved beyond their capabilities although some were able to suggest how tension might result in extension and thinning which caused the land sediments to end up below sea level.

(b) (i) Generally well answered. However, some candidates interpreted the area as being under compression and put all three sets of arrows the wrong way round. A significant minority of candidates got 'C' wrong despite getting the other two correct.

(ii) This was not particularly well answered – a lot of candidates gave very general answers and did not attempt to explain the *direction* of movement. Thus many gave the constructive plate boundary as part of their explanation but then failed to explain the direction of their arrows (at right angles to the ridge axis.)

(c) (i) Generally well answered, no significant problems, except for those candidates who confused compass directions e.g. "the basalts are found mainly to the SE on either side of the continental rift."

(ii) Again, generally well answered – however, there does seem to be a fairly widespread misunderstanding of the term "viscosity." Some otherwise high scoring candidates, having stated that the basalts are very widespread, then said that they had a "high viscosity." Others stated that the flood basalts had "no viscosity" or were "non-viscous."

(d) Not particularly well answered – many candidates did not appear to appreciate that the structural features were shallow because of thinned continental crust and oceanic crust. Some candidates got completely confused and despite appreciating that this was an extensional tectonic environment in the earlier parts of the question, talked about the influence of subduction zones etc.

(e) Reasonably well answered, although some candidates jumped too far ahead in the Wilson cycle and talked about the initiation of subduction zones, the closure of the ocean and the formation of mountain belts.

Q.2 This question was generally reasonably well answered. Many candidates spent more time on the magnetic anomaly part of the question and not enough time to do proper justice to the mantle plume part. Also, too much effort was often devoted to explaining the origin of striping rather than its use.

Some candidates made no mention of the fact that for both these techniques, accurate dating of the rocks is essential. Where dating was mentioned, most candidates focussed on K-Ar dating. K-Ar dating is **very rarely** used these days as it is widely regarded as being highly inaccurate, particularly for MOR basalts which may have interacted with seawater. The modern methods for dating ocean floor basalts are ^{40}Ar - ^{39}Ar dating (if the rocks are older than ~2 Ma) or U-Th-series disequilibria dating (using short-lived intermediate isotopes in the U-Th decay series) for more recent eruptions. (N.B. this is not to be confused with U-Pb dating which is only suitable for very old rocks.)

Evaluation for this question was on the whole quite good, with many candidates talking about mantle plumes possibly not being stationary, uncertainties in age dating and resetting of the palaeomagnetic signature in altered rocks.

Q.3 This was the most popular question, and all the candidates that scored high marks made good use of labelled cross-sections to illustrate the characteristics of a subduction zone. A very surprising fact is the number of (often high scoring) candidates who did not acknowledge a trench. Most candidates seem to be under the illusion that the melting in a subduction zone is due to melting of the subducted plate. Unless the crust is young (<10 Ma) and therefore hot (high geotherm) the subducted oceanic crust will not melt. Young oceanic crust is only currently being subducted in a few places on Earth and the resultant slab melts are very distinctive – a rock type known as 'adakites'. In >95% of present day subduction zones the slab is old and cold and as it descends, water and volatiles are driven off into the overlying asthenospheric mantle wedge, lowering the solidus and causing melting.

Very few mentioned that the slab becomes denser as it descends. It was nice to see a few bring in the significance of ophiolites in their discussion/evaluation.

Q.4 Only attempted by a small number of candidates. Part (a) was generally much better answered than part (b). The main problem was that there was too much focus on the general features of an orogenic belt and often only a brief mention of the importance of isostasy. Very few candidates mentioned the fact that the formation of over thickened crust can lead to significant amounts of crustal melting e.g. Himalayas. Very few candidates attempted any evaluation.

GEOLOGY

General Certificate of Education 2010

Advanced

Coursework Module GL6

Principal Moderator: Mr Ian G. Kenyon

Unit Statistics

The following statistics include all candidates entered for the unit, whether or not they 'cashed in' for an award. The attention of centres is drawn to the fact that the statistics listed should be viewed strictly within the context of this unit and that differences will undoubtedly occur between one year and the next and also between subjects in the same year.

Unit	Entry	Max Mark	Mean Mark
GL6	936	60	43.3

Grade Ranges

A	48
B	42
C	36
D	30
E	24

Administration

The administration and moderation of the coursework samples ran quite smoothly once again this year. The Principal Moderator is very grateful for the efficient organisation and punctuality of the majority of centres. Only a small number of centres submitted materials after the May 15th deadline.

Packaging Coursework

When packing the coursework samples please try to reduce bulk and weight as far as possible. A4 hardback ringbinders 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 the relevant pages of field notes and inserting them in the front of the report with a paper clip. Alternatively photocopy the relevant pages and include in the front of the report. All materials for moderation should be included in just one modest sized package.

Please note that the coursework samples for GL6 and GL2b should not be sent together in the same package as they are moderated by different examiners. If centres are unsure about the address for despatch, they should contact WJEC for clarification.

Fieldwork and Laboratory based Investigations

Please note that the requirements for GL6 are a minimum of two investigations. The assessment must be a minimum of 50% field based work. Therefore three possible combinations are available. Field 50%/Lab 50%, Field 75%/Lab 25% or Field 100%. Please state clearly on the GLF1 form whether Lab (L) or Field (F) is being assessed. It is not appropriate to write F/L.

GLF1 Forms

A completed F1 form should be included with the coursework sample. This is used by the moderator to make any recommendations for mark adjustments. Please note that it is not necessary to write out the details of the investigations undertaken in the space allocated on the right hand side of the form. The F1 form should list **all** candidates and their marks from the centre, not just those selected as a sample for moderation. It is helpful to mark with an asterisk on the left hand side those which are included in the sample.

F2 Forms – The Tracking/Planning Sheet

A completed F2 form should be included for each investigation undertaken, i.e. two for each candidate in the sample. This is used primarily to assess the planning of the investigation. The quality of the planning sheets varied from exceptional, exhaustive and comprehensive to inadequate, over-brief and quite vague. The best marks for planning were achieved where candidates carried out a pilot study to test their planning, then modified the original plan in the light of this. A significant number of centres were over-generous on awarding marks for planning. It is not possible to score full marks on this section when candidates have failed to make any predictions about possible outcomes and anticipated sources of error.

These sheets can be enlarged to A3 where space is insufficient. Additional planning information can be included at the beginning of the written report under a clear 'planning (F2) continued' heading.

should be encouraged to plan in detail and should be discouraged from using simplistic bullet point statements on the planning sheet.

F3 Forms

A completed F3 form should be submitted for each candidate in the sample. Please make full use of the opportunity to comment on the work of individual candidates on the F3 form. Ideally, 4 'post-it' notes should be used to locate within the work, where and why the marks have been awarded. A few centres still fail to comply with this request each year and possibly disadvantage their candidates as a result.

Please ensure that the centre has the updated F3 form which has the candidate declaration on the reverse. This must be signed by the candidate and teacher to confirm the authenticity of the work being submitted.

Downloads from WJEC

Copies of the forms F1, F2 and F3 can be downloaded directly from the WJEC website www.wjec.co.uk by following the GCE/AS subjects and then Geology links from their home page.

C Forms

Please note that the C forms (red/pink) for recording candidates' marks should be sent directly to WJEC and not the moderator of coursework.

Implementation

In order to provide evidence for implementation, it is vital that the appropriate field and laboratory notes are included with the report.
A small number of centres failed to include the laboratory notes again this year.

It should also be noted that laboratory work must yield some raw data that could not be collected in the field. Bringing back rock samples then describing them as in a 'traditional' practical is not really in the spirit of the assessment.

Good examples of lab work included:

Making thin sections of rock samples followed by microscope analysis
Sieving sediments and calculating sorting, skewness and kurtosis
Establishing composition of sediment samples using point counts
Testing rock samples for resistance to abrasion, impact and polishing
Modelling rock deformation using plasticine and mars bars
Simulating mass movements and tsunami generation in a wave tank
Porosity and permeability of rocks related to their utilization potential
Testing the resistance of various mollusc shells to abrasion/attrition and linking to preservation potential

The overall quality and quantity of the lab and field notes were a little disappointing again this year and could easily be improved upon. Field sketches were particularly poor.

Ideally each field location should have a six-figure grid reference. If sites are close together, then the same reference should be given with '12 metres west of site 4'. It was pleasing to note some very accurate fieldwork locations were given by a few centres using GPS.

All field sketches should have grid reference, scale, compass orientation and detailed annotations. Simplistic labelling of sketches should be discouraged.

Information from secondary sources such as bed ages or detailed palaeogeographies should not appear in the field notes. Photographs are also inappropriate in the field notes. The field notes should be used to interpret the photographs in the report.

Field notes should consist of detailed observations, measurements and records made individually by each candidate. Identical notes obviously dictated in the field are to be strongly discouraged.

It is strongly recommended to practise field sketching from photographs or slides prior to fieldwork being carried out. The field and lab notes provide the basis for the report and should be considered the most important part of the investigation.

Analysis

This involves some synthesis and interpretation of the primary data collected in the lab or field. There must be some development from the field or lab notes, rather than simply copying out the same information in a neater form.

The use of photographs is to be strongly encouraged but these should be used selectively and integrated within the text. Transparent overlays or outline diagrams adjacent to photographs may be used to highlight important features or annotated digitally. Grid reference, compass orientation and scale should be included as a matter of course.

Please discourage the indiscriminate use of photographs, which lack location and annotations. Only include photographs, which are directly relevant to the investigation. As a general guide no more than 8 to 10 photographs should be included. Less than half the candidates included photographs this year and the majority were poorly annotated.

Statistical analysis is recommended if it is appropriate to the data collected. Excellent investigations on sedimentary environments included work on sorting, skewness and kurtosis. Particle size and shape was assessed using Zinng's, Krumbein's and Cailleux's indices. Spearman's Rank, Chi Square and Vector analysis were also used by some centres. Point counts were used to assess the mineralogical composition of rock and sediment samples.

Spreadsheets were used by a number of centres, but not always to the best effect. Printouts of cumulative frequency graphs, Zinng diagrams and histograms were rarely annotated to show evidence of thorough analysis and interpretation.

Evaluation

Evaluation must be included as a separate section within the report. It is an opportunity for candidates to reflect objectively on the work they have carried out. The quality of evaluations varied from sophisticated and thorough to simplistic and inappropriate. It may be worthwhile suggesting to candidates to break up the evaluation into a number of distinct components:

Evaluating the planning sheet they completed. How appropriate were the techniques and methods they selected? This may refer to methods of sampling, sample size and sample number.

What problems or limitations were encountered during implementation? This could involve reference to confusion between true and apparent dip or problems between the base map geology and actual rock outcrops.

An outline of the way in which the investigation could be improved, given more time and/or resources and with the benefit of hindsight.

An overview of the investigation based on the likely reliability/validity of the data collected in the available time frame. Which part(s) of the investigation(s) yielded the most/least reliable data and why? Are the conclusions made concrete, tentative or partial? How do these findings compare with published work on the same area/topic? How do they compare with the results/conclusions of candidates from last year? How could the work be developed further, with perhaps reference to the outline planning of extension work?

Evaluation is not a list of excuses. Naïve and simplistic statements regarding lack of time, bad weather and lack of familiarity with equipment do not form the basis of a mature evaluation. As a rough guide one side of A4 word-processed text is a probable minimum length for evaluation.

The Report

It is now expected that candidates make use of IT and finish reports to a professional standard. It was encouraging to see so many centres making appropriate use of IT and just a few hand-written reports were submitted this year.

As a rough guide, the optimum length for each report should be between 1250 and 1750 words. This excludes maps, diagrams, photographs, graphic logs and statistics. Quality rather than quantity is to be encouraged. The reports should be concise, relevant and clearly focused.
Please dissuade candidates from including large amounts of photocopied material from secondary sources.

The report should be based on the primary data collected in the lab or field and there should be some cross-referencing between the two. Safety considerations should be briefly acknowledged and candidates should be encouraged to be aware of the importance of the need for conservation of geological sites. The report might include the following sections, though they may be subsumed under a smaller number of headings:

Contents Page
Location Map
Introduction
Aims/Hypotheses
Safety Aspects
Methods Of Data Collection
Data Presentation
Data Analysis
Statistical Analysis
Graphs/Printouts With Annotations
Photographs With Annotations
Conclusions
Evaluation
Bibliography
Acknowledgements

Standards

The standard of coursework marking this year has not been as reliable as in previous years. With the introduction of the A* grade at A2 it seems that a number of centres have erred on the side of generosity when awarding marks for coursework, particularly in the planning and evaluation components. Consequently there were more adjustments to teacher marks this year than in any previous year of this specification.
In 2010 ten centres were adjusted downwards and four were adjusted upwards.

Help and advice is available from the Principal Moderator at any time. Contact email address iangkenyon@aol.com

Coursework for 2011 can be submitted any time after 1st May and the final deadline for submission is May 15th.

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