GENERAL CERTIFICATE OF EDUCATION
TYSTYSGRIF ADDYSG GYFFREDINOL

2009 - 2010

GEOLOGY

SPECIMEN QUESTION PAPERS
SPECIMEN MARKING SCHEMES
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GEOLOGY – GL1

FOUNDATION GEOLOGY

SPECIMEN PAPER

(1 hour)

ADDITIONAL MATERIALS

In addition to this examination paper, you will need a Mineral Data Sheet.

INSTRUCTIONS TO CANDIDATES

Write your name, centre number and candidate number in the spaces at the top of this page. Answer all questions in the spaces provided in this booklet.

INFORMATION FOR CANDIDATES

The number of marks is given in brackets at the end of each question or part-question.

You are reminded that assessment will take into account the quality of written communication used in your answers.

No certificate will be awarded to a candidate detected in any unfair practice during the examination.
GL1. FOUNDATION GEOLOGY

Answer all questions

1. **Figure 1a** shows features of the Earth's surface in part of southern Asia. **Figures 1b** and **1c** show cross-sections through the lithosphere along the lines **A-B** and **C-D** marked on **Figure 1a**.

![Figure 1a](image1)

**Figure 1a**

![Figure 1b](image2)

**Figure 1b**

![Figure 1c](image3)

**Figure 1c**

(a) State the type of plate boundary **X-Y** shown in **Figure 1a**. [1]

Plate boundary type ...........................................................................................................

(b) (i) Explain the origin of the mountain range along the cross-section **A-B**. [2]

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(ii) Describe how the height of the mountain range may change over time. Give reasons for your answer. [2]

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(c) (i) Draw onto the cross-section C-D in Figure 1c, using the symbol xxx, the most likely distribution of earthquake foci. [1]

(ii) Explain why the earthquake foci have this distribution. [2]

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(d) Igneous activity along the cross-section C-D involves the generation of magma at depth and the eruption of lava.

(i) Name the lava most typical of this type of plate boundary. [1]

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(ii) Explain the formation of magma at this type of plate boundary. [3]

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(e) Explain how processes at the Carlsberg Ridge are linked to the plate movement at plate boundary X-Y in Figure 1a. [3]

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Total 15 marks
2. **Figure 2a** shows the travel-times for S (shear)-waves to different parts of the Earth following the Mexican earthquake in 1999.

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**(a)**

(i) Mark on **Figure 2a** with a labelled arrow (← E) the approximate epicentre of the Mexican earthquake.  

(ii) The S-wave travel path from the epicentre to Hawaii is 6600 km long. Calculate the mean velocity of S-waves (in km per second) reaching Hawaii. Show your working.  

Mean velocity …………………… km s⁻¹  

(iii) Explain why S-waves were not recorded in Australia.  

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(b) **Figure 2b** and **Figure 2c** are sections through the Earth showing the variation in seismic wave velocities and density with depth.

![Figure 2b and Figure 2c](image)

<table>
<thead>
<tr>
<th>Depth (km)</th>
<th>Seismic velocities (km/s)</th>
<th>Low</th>
<th>Density</th>
<th>High</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1000</td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td>2000</td>
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<tr>
<td>3000</td>
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<tr>
<td>6000</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Centre of the Earth</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- **S-wave**
- **P-wave**
- **Mantle/outer core boundary**
- **Outer core/inner core boundary**

(i) Mark with a labelled arrow (← A) the depth of the asthenosphere on the P-wave curve (**Figure 2b**). [1]

(ii) Complete the figures by sketching the main changes, with depth, in:

1. S-wave velocities (**Figure 2b**) [2]
2. The density of the Earth (**Figure 2c**) [2]

(c) With reference to **Figures 2b** and **2c** and your own knowledge, give and explain, one piece of evidence that:

(i) the Earth has a solid inner core. [2]

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(ii) the Earth's core is composed largely of iron. [2]

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**Total 15 marks**
3. **Figure 3** is a field sketch of an **inverted** (overturned) sequence of rocks.

Refer to **Figure 3**.

(a) State the type of igneous body represented by rock unit A. Explain your answer. [3]

Type of igneous body ........................................................................................................

Explanation .....................................................................................................................

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(b) (i) State the type of sedimentary structures labelled:

Structure X ....................................................................................................................... [1]

Structure Y ....................................................................................................................... [1]
(ii) Using the evidence from Figure 3, describe the sedimentary environment associated with the formation of one of the following rock units:

<table>
<thead>
<tr>
<th>either</th>
<th>Limestone C</th>
</tr>
</thead>
<tbody>
<tr>
<td>or</td>
<td>Sandstone D</td>
</tr>
</tbody>
</table>

[3]

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(c) Clearly mark, with a labelled arrow on Figure 3, a location where each of the following rock types may be found:

Marble (use arrow labelled ←M)
Spotted Rock (use arrow labelled ←S)

Explain your answer in each case. [4]

Marble ..................................................................................................................... ......
............................................................................................................................. ............

Spotted Rock ............................................................................................................. ..
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(d) Explain how the field relationships in Figure 3 provide evidence that the sequence is overturned. [3]

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Total 15 marks
4. Figure 4 is a field sketch of a quarry showing to the faces (X and Y) at right angles to each other. Face X has rock layers showing true dips to east and west.

(a) Complete Figure 4 by drawing the geology onto Face Y and explain your answer.

[3]

Explanation ........................................................................................................................................
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(b) (i) Draw and label on Figure 4 the position of the axis of a fold. [1]

(ii) Describe the folding shown in Figure 4. [2]

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(c) The beds have been displaced vertically along the fault labelled F in Figure 4.

(i) Calculate the throw of the fault, giving your answer to one decimal place.

Throw …………………………………m [1]

(ii) Name the type of fault illustrated.

Type of fault……………………………………………..[1]

(d) State, with the reason, which of the following pairs is older:

(i) **Igneous rock A** or the **Limestone** [2]

Older …............................................................................................................

Reason …............................................................................................................

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(ii) **Igneous rock A** or the **Fault** [2]

Older………………………………………………………………………………

Reason………………………………………………………………………………

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(iii) **Sandstone B** or the **Sandstone C** [3]

Older………………………………………………………………………………

Reason………………………………………………………………………………

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Total 15 marks
GEOLOGY – GL2a

INVESTIGATIVE GEOLOGY

SPECIMEN PAPER

REFERS to RESOURCE SHEET of MAY 2005 AS Paper GL2a

(1 hour 30 minutes)

ADDITIONAL MATERIALS

In addition to this examination paper, you will need:
• the Resource Sheet;
• the Mineral Data Sheet;
• Specimens A, D and K
• geological equipment for testing specimens.

INSTRUCTIONS TO CANDIDATES

Answer all questions. Questions 1-3 may be completed in any order.
Write your name, centre number and candidate number in the spaces at the top of this page.
Write your answers in the spaces provided in this booklet.

INFORMATION FOR CANDIDATES

The geology is not designed to represent any particular area.
Map 1, Photographs 1 to 4 number Mineral Data are provided on separate resource sheets.
These are not required for marking.
Strips of plain paper may be obtained from the Supervisor on request.
These are not required for marking.

Three specimens, A, D and K are provided for use.
All may be tested with the equipment specified by the Supervisor.

The number of marks is given in brackets at the end of each sub-question.

You are reminded that assessment will take into account the quality of written communication used in your answers.

No certificate will be awarded to a candidate detected in any unfair practice during the examination.
Answer ALL the questions in the spaces provided.

Study Map 1 on the Resource Sheet carefully before answering Questions 1 – 5.

1. Specimen A was collected from an exposure of Rock Unit A on Map 1.

(a) Using only evidence from Map 1, give reasons why rock Rock Unit A is part of a pluton. [2]

- It has a concordant margin
- It has a discordant margin
- It is unconformable
- It passes into a dyke

Tick two boxes only

(b) Use a hand lens to study Specimen A.
Complete Figure 1 below by drawing, to scale, the texture of Specimen A. [4]
(c) Specimen A contains feldspar, quartz and mica.

Table 1, below, specifies two mineral pairs. For each pair, describe and carry out, using only the equipment specified by the supervisor, a simple test/observation which will allow you to distinguish between the two minerals. You must choose a different test/observation for each pair.

Complete Table 1 by:

1. stating the physical property to be tested/observed;
2. briefly describing each test/observation;
3. recording the result of each test/observation. [6]

<table>
<thead>
<tr>
<th></th>
<th>(1) property tested/observed</th>
<th>(2) description</th>
<th>(3) result</th>
</tr>
</thead>
<tbody>
<tr>
<td>feldspar and mica</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>feldspar and quartz</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 1

Total 12 marks
2. (a) **Photograph 1** on Page 4 of the Resource Sheet shows igneous structures within **Rock Unit B, a basalt**.

(i) Describe the shape of the structure labelled S. ................................................................. [2]

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(ii) Name the structures. ........................................................................................................... [1]

(b) Structures, such as the ones in **Photograph 1**, are useful as **way up criteria** to help determine the relative age of a rock sequence. With reference to your fieldwork, or other examples you have studied:

(i) name a locality where you have studied (or might study) way up criteria. [1]

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(ii) describe how you would plan to record this information in the field. [2]

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(iii) explain how these structure(s) enable you to determine the relative ages of a rock sequence. You may wish to illustrate your answer with a labelled diagram(s). [5]

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Total 11 marks
3. **Map 1** shows only the solid outcrop of **Rock Units A - J**.

Surface processes such as weathering, erosion, and transport can lead to the deposition of superficial deposits which lie on top of the solid outcrop.

(a) **Photograph 2** on page 4 of the Resource Sheet shows detail of one such superficial deposit found in the area of **Map 1**.

(i) Complete **Table 3**, below, by describing the sorting, shape and size of the deposit. [3]

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sorting</td>
<td></td>
</tr>
<tr>
<td>Shape</td>
<td></td>
</tr>
<tr>
<td>Size</td>
<td></td>
</tr>
</tbody>
</table>

(ii) It is thought that:

"**this deposit was formed by fluvial rather than aeolian processes.**"

Evaluate this statement with reference to **two** of the characteristics of the deposit (sorting, shape or size). [4]

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.............................................................................................................................. ........................
(b) **Photograph 3** on page 4 of the Resource Sheet is a clast from the superficial deposit shown in **Photograph 2**. It was weathered from **Rock Unit C** on **Map 1**.

(i) Rocks can be igneous, metamorphic or sedimentary in origin. Suggest, giving **one** reason from **Photograph 3**, why **Rock Unit C** is metamorphic. [1]

Reason 1 ...................................................................................................................................................
...................................................................................................................................................................

(ii) Name the rock type representative of **Rock Unit C**. [1]

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(iii) State the type of weathering which is most likely to have released the clast shown on **Photograph 3** from **Rock Unit C**. [1]

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(iv) **Specimen K** is representative of **Mineral K** in **Photograph 3** which suggests that:

"**Mineral K** resists erosion during transport."

1. Using the equipment specified by the supervisor, describe and carry out **one** test on **Specimen K** to investigate this statement.

2. Describe **one** piece of evidence from **Photograph 3** to confirm your finding. [3]

Description of test. ........................................................................................................................................
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Test result/observation. ....................................................................................................................................
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Supporting evidence from **Photograph 3** ........................................................................................................
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Total 13 marks
4. (a) Map 2 below, shows detail of a small area of Map 1. The relief of the area of Map 2 is almost level.

The key to Map 2 shows the relative ages of Rock Units C, D and E. These have been folded into what is thought to be a symmetrical syncline.

(i) Mark on Map 2 the axial plane trace of the fold. Label this line using the letters APT.

(ii) Complete Table 4 below, to evaluate the description of the fold as a symmetrical syncline. For each statement, indicate in the evaluation column whether it is true or false, giving one reason in each case.

<table>
<thead>
<tr>
<th>Statement</th>
<th>Evaluation</th>
<th>Reason</th>
</tr>
</thead>
<tbody>
<tr>
<td>Symmetrical</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Syncline</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 4
(b) Fault F1 on Map 1 is interpreted as a major transcurrent (wrench/tear) fault with a strike slip displacement of many kilometres. This has resulted in two sets of folded rock units being brought into outcrop next to each other. Evidence suggests that these two sets of Rock Units (C, D, E and F, G, H) represent different geological eras.

(i) State, giving evidence from Map 1, how the trend and wavelength of folding suggests an age difference between these two sets of rock units. [2]

<table>
<thead>
<tr>
<th>Trend</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>........................................................................................................</td>
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<td>........................................................................................................</td>
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</tbody>
</table>

Wavelength ........................................................................................................... ....

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(ii) Specimen D contains fossils representative of Rock Unit D. Photograph 4 on page 4 of the Resource Sheet is a fossil collected from Rock Unit F on Map 1.

Complete Table 4 below, by naming the Fossil Groups found in Rock Units D and F. Suggest the era each of these Rock Units represents from the following list:

<table>
<thead>
<tr>
<th>Cainozoic</th>
<th>Lower Palaeozoic</th>
<th>Mesozoic</th>
<th>Precambrian</th>
<th>Upper Palaeozoic</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Fossil group</th>
<th>Era</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rock Unit D (Specimen D)</td>
<td></td>
</tr>
<tr>
<td>Rock Unit F (Photograph 4)</td>
<td></td>
</tr>
</tbody>
</table>

Table 4

Total 9 marks
The topographic profile below was taken along line X-Y on Map 1.

- Complete the sketch of the geological cross-section along this line. Use information from surface outcrops.
- Part of Rock Unit F has been inserted.
- Project your sketch above the topographic surface where appropriate, in order to any show cross-cutting relationships.
- Label the faults, using the letters on Map 1, and draw arrows to show movement.
- Label any fold axes, using the terms antiform and synform, (or symbols).
- Use similar ornament, or letters, for the Rock Units as on Map 1.
GEOLOGY – GL3

GEOLOGY and the HUMAN ENVIRONMENT

SPECIMEN PAPER

(1 hour 15 minutes)

ADDITIONAL MATERIALS

In addition to this examination paper, you may require a calculator.

INSTRUCTIONS TO CANDIDATES

Write your name, centre number and candidate number in the spaces at the top of this page.
Answer all questions from Section A and one from Section B.
Write your answers in the spaces provided in this booklet.

INFORMATION FOR CANDIDATES

The number of marks is given in brackets at the end of each question or part-question.
Candidates are reminded that marking will take into account the use of examples and the quality of written communication used in your answers, especially in the structured essay - Section B.

No certificate will be awarded to a candidate detected in any unfair practice during the examination.
SECTION A

Answer both questions 1 and 2 on the lines provided in the question.

1. Table 1 is an account of the events leading up to the major eruption of Mount St. Helens in 1980. Figure 1 shows profiles of Mount St. Helens together with earthquake data associated with the May 18th eruption.

Volcanic activity at Mount St. Helens began on 27th March, 1980 with explosive ash and steam eruptions.

"At 8:32 A.M. on May 18, Mount St. Helens was shaken by a magnitude 5 earthquake, centred 1 to 2 kilometres beneath its north flank. Geologists Keith and Dorothy Stoffel, who were flying in a light plane about 400 metres above the summit at just that moment, saw several icefalls start down the steep crater walls. About fifteen seconds later they were the closest witnesses to the onset of the largest landslide in recorded history, closely followed by a huge volcanic eruption. The whole north side of the summit crater began to move instantaneously as one gigantic mass", Dorothy recalled. Seconds later a massive explosion shook the mountain."

Table 1

Table 1

Source- adapted from Volcanoes - Decker 1998: W.H Freeman and Co.

Figure 1

Source- adapted from Volcanoes - Decker 1998: W.H Freeman and Co.
Refer to Table 1 and Figure 1

(a) Give a name for Feature X (12th May profile) and explain its origin [2]

Feature X ...........................................................................................................................................

Origin ................................................................................................................................................
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(b) Explain how the distribution and type of seismic activity in Figure 1 might indicate a possible volcanic eruption. [3]
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(c) (i) Suggest two factors most likely to have been responsible for triggering the landslide. [2]

Factor ................................................................................................................................................

Factor ................................................................................................................................................
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(ii) Using all the data provided, account for the shape of the post-eruption profile. [3]
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(d) Describe the use of one technique by which ground deformation of the northern bulge might have been monitored. [2]
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Total 12 marks
2. Crustal deformation can be used in the prediction of earthquakes by measuring changes in the distance between two fixed points along a survey line.

**Figure 2a** is a map of central California showing survey lines (A - D) across the San Andreas Fault system. **Figure 2b** shows the changes in the lengths of these survey lines over time.

Refer to **Figures 2a and 2b**

(a)  
(i) State the major difference to changes in the length of survey lines A and B between 1959 and 1969.  
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(ii) Calculate the **average** rate of change in the length of survey line B for the 10 year period (1959 – 1969). Show your working.

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......................................................................................................................................................cm/year.
(iii) Compare the average rate of change in the length of survey line C with that for survey line B over the same period. Account for the difference. [3]

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(b) Using the data, draw two arrows in the box on Figure 2a, to show the direction of relative movement on either side of the Hayward fault. Explain the evidence from the survey lines for your answer. [2]

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(c) Explain how the type of survey shown might enable earthquakes to be predicted. [2]

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(d) From your knowledge, explain one other method used to predict earthquakes. [3]

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Total 13 marks
SECTION B

Answer one question from this Section on the following pages.

The marks you will be awarded in your essay take into account:
- evidence of geological knowledge and understanding;
- the use of geological examples;
- legibility, accuracy of spelling, punctuation and grammar;
- the selection of an appropriate form and style of writing;
- the organisation of material, and use of geological vocabulary, in the essay.

EITHER,

3.  (a) Describe, giving reasons, the geological facts that need to be considered in the disposal of highly toxic and/or radioactive waste compared with the disposal of domestic waste. [15]

(b) With specific reference to one actual (or potential) landfill or underground site, analyse the suitability of the site for the type of waste disposed. [10]

OR,

4.  Using one or more case studies,

(a) describe the extent to which the destructive effects of lava flows might be controlled. [10]

(b) describe and explain the difference in the hazards typically associated with the eruption of

(i) basaltic and
(ii) andesitic magmas. [15]

OR,

5.  With the aid of diagrams:

(a) describe how the foundations of large structures can be affected by:
- unstable patterns of geological structures (e.g. bedding, jointing, faulting, cleavage); and
- depth to the water table and rockhead. [15]

(b) explain how marine erosion and deposition may be influenced by civil engineering work in coastal areas. [10]
GEOLOGY – GL4

INTERPRETING the GEOLOGICAL RECORD

SPECIMEN PAPER

(2 hours)

ADDITIONAL MATERIALS

In addition to this examination paper, you will need:

• the Geological Map extract (Castleton)
• a hand-lens or magnifier to study the map (optional)
• a calculator.

INSTRUCTIONS TO CANDIDATES

Write your name, centre number and candidate number in the spaces at the top of this page. Answer all questions.
Write your answers in the spaces provided in this booklet.

INFORMATION FOR CANDIDATES

The number of marks is given in brackets at the end of each question or part-question.

You are reminded that assessment will take into account the quality of written communication used in your answers.

No certificate will be awarded to a candidate detected in any unfair practice during the examination.
SECTION A

Answer all questions in the spaces provided.
This Section should take approximately 1 hour to complete

1. Figure 1a is a skeleton of the bird-hipped dinosaur, Stegosaurus.

(a) Refer to Figure 1a.

(i) Name the morphological feature X and explain its function. [2]

Name of feature X ...........................................................................................................

Function ............................................................................................................................
........................................................................................................................................

(ii) Suggest a probable function for the horns and plates. [2]

Horns ................................................................................................................................
........................................................................................................................................

Plates ..................................................................................................................................
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(iii) Explain how the evidence from the skeleton supports the conclusion that Stegosaurus was a herbivore (plant eater). [3]

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(b) **Figure 1b** is a sketch of two dinosaur trackways (A and B) from which estimates of various dinosaur characteristics can be determined.

(i) Complete the table below by using the information from **Figure 1b** to estimate the characteristics of the two dinosaurs (A and B) that made the tracks. [4]

<table>
<thead>
<tr>
<th>Dinosaur</th>
<th>Hind foot length (FL) metres</th>
<th>Stride length (SL) metres</th>
<th>Hip height (h) metres ($h = 4 \times FL$)</th>
<th>Relative stride length (SL/h)</th>
<th>Speed (km/hr)</th>
<th>Gait (running, trotting, walking)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>0.23</td>
<td>•</td>
<td>•</td>
<td>2.83</td>
<td>17.3</td>
<td>trotting</td>
</tr>
<tr>
<td>B</td>
<td>•</td>
<td>2.1</td>
<td>1.40</td>
<td>1.50</td>
<td>8.55</td>
<td>•</td>
</tr>
<tr>
<td>Hadrosaur (example)</td>
<td>0.38</td>
<td>1.4</td>
<td>1.52</td>
<td>0.92</td>
<td>4.46</td>
<td>walking</td>
</tr>
</tbody>
</table>

(ii) Using all the data, critically evaluate the hypothesis that a Stegosaurus, such as that in **Figure 1a**, formed trackway B in **Figure 1b**. [4]

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**Key**

FL - hind-foot print length
SL - stride length of either left/right foot

$h(\text{hip height}) = 4 \times \text{foot print length (FL)}$

Relative stride length ($SL/h$) is used to determine whether the animal is

- Walking - ($SL/h <= 2.0$)
- Trotting - ($SL/h > 2.0$ and $<2.9$)
- Running - ($SL/h >= 2.9$)

**Figure 1b**

Total 15 marks
2. **Figure 2a** is a phase diagram showing the experimental crystallisation of plagioclase feldspar over a range of compositions (from Na-rich Albite to Ca-rich Anorthite).

**(a)** Name the variety of plagioclase feldspar to crystallise at the highest temperature.

.............................................................................................................................

**[1]**

**(b)** Melt P on **Figure 2a** has the composition of 35% sodium (Na) rich plagioclase : 65% calcium (Ca) rich plagioclase.

Complete the box below to show the crystallisation characteristics of melt P as it cools, assuming that the melt remains in equilibrium with the crystals that form.

<table>
<thead>
<tr>
<th>Melt P</th>
<th>Temperature of melt (°C)</th>
<th>Composition of melt (% Na: % Ca)</th>
<th>Composition of crystals (% Na: % Ca)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initial crystallisation</td>
<td>✓</td>
<td>35:65</td>
<td>✓</td>
</tr>
<tr>
<td>Crystallisation at 1400°C</td>
<td>1400</td>
<td>✓</td>
<td>25:75</td>
</tr>
<tr>
<td>Final crystallisation</td>
<td>✓</td>
<td></td>
<td>✓</td>
</tr>
</tbody>
</table>
(c) **Figure 2b** is a polished surface showing the texture of an igneous rock.

With reference to **Figure 2a** and to the zoned plagioclase crystal (X) in **Figure 2b**;

(i) state the probable difference in composition of zones I and II; [1]

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(ii) account for this variation in composition. [3]

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(d) Explain why the plagioclase crystals of the groundmass are not zoned. [2]

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(e) From your knowledge, describe one process during the emplacement or crystallisation of an igneous rock that would produce a magma with a **different** composition from the original melt. [3]

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**Total 15 marks**
3. **Figure 3a** is a partly completed block diagram of a dip slip fault. Rocks X and Y are diagrams of rock types found at the localities indicated on the fault plane.

![Figure 3a](image)

**(a)** (i) Complete the table below to describe the fault characteristics. [4]

<table>
<thead>
<tr>
<th>Fault characteristics</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strike direction</td>
<td>•</td>
</tr>
<tr>
<td>Downthrow direction</td>
<td>•</td>
</tr>
<tr>
<td>Amount of strike-slip movement</td>
<td>NONE</td>
</tr>
<tr>
<td>Principal stress component (σ) parallel to strike direction</td>
<td>•</td>
</tr>
<tr>
<td>Type of fault</td>
<td>•</td>
</tr>
</tbody>
</table>

(ii) Complete the top surface of Figure 3a to show the probable outcrop of the shale and dolerite to the north of the fault outcrop. Clearly label your outcrops. [2]

**(b)** Rocks X and Y were both formed at the same time.

(i) Describe the texture of rock X. [3]
(ii) Account for the differences in texture of rocks X and Y with reference to their behaviour during fault movement. [2]

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(c) **Figure 3b** is a photograph of an exposed vertical face of a fault plane at another locality.

(i) Name the structures exposed on the fault plane. [1]

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(ii) Critically assess the use of these structures in determining the fault movement. You may wish to annotate **Figure 3b**. [3]

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**Figure 3b**

(iii) Name the structures exposed on the fault plane. [1]

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(ii) Critically assess the use of these structures in determining the fault movement. You may wish to annotate **Figure 3b**. [3]

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**Total 15 marks**
4. **Figure 4**, a simple Sepkoski curve, shows the changes in the diversity of life during the past 600Ma

![Figure 4](image)

(a) In **Box X** on **Figure 4**, label a geological age during which:

(i) ediacaran fauna were the most common form of life. Label with the letter "E" [1]

(ii) "icehouse" conditions, similar to the Quaternary, were experienced in the Phanerozoic. Label with the letter "I" [1]

(b) (i) Name the boundary at which the greatest number of faunal families became extinct. [1]

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(ii) Calculate the percentage of existing families that became extinct during this event. Show your working. [2]

....................................................................................................................................................................................%
(c)  
(i) On the graph shown in Figure 4, mark the K-T boundary mass extinction event with an arrow (↓ K-T) [1]  

(ii) Give two examples of faunal groups that became extinct at the K-T boundary. [2]  

Faunal group 1…………………………………………………………………………  
Faunal group 2…………………………………………………………………………  

(iii) Briefly outline two contrasting hypotheses that have been put forward to account for the K-T mass extinction. [4]  

1. ….......................................................................................................................... ...........  
............................................................................................................................. ...........  
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............................................................................................................................. ...........  

2. ….......................................................................................................................... ...........  
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(d) Explain why the small number of families recorded at the Precambrian - Cambrian boundary does not necessarily reflect the abundance of life at that time. [3]  
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Total 15 marks
SECTION B

Questions 5 – 8 relate to the British Geological Survey 1:25 000 geological map extract of Castleton

Answer all questions in the spaces provided.
This section should take approximately 1 hour to complete.

5. (a) Describe the outcrop distribution of the Apron-Reef (Rap), within the Lower Carboniferous, Bee Low Limestones (BLL), across the area of the geological map[2]

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(b) Refer to the geology north of gridline 83 on the geological map.

Complete the table below by describing the map evidence for the relative age of each of the following sets of strata:

1. Bee Low Limestone (BLL) and Millstone Grit (Edale Shales) (MG);

2. Head and landslide deposits. [2]

<table>
<thead>
<tr>
<th>Beds/deposits in order of age (oldest at base)</th>
<th>Map evidence for relative age</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Landslide</td>
<td>•</td>
</tr>
<tr>
<td>Head</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Edale Shales (MG)</td>
<td>•</td>
</tr>
<tr>
<td>Bee Low Limestones (BLL)</td>
<td></td>
</tr>
</tbody>
</table>
Along the line of the cross section the Shale Grit (SG) of the Upper Carboniferous within grid square 1183 is shown to be dipping very gently.

(i) Describe the outcrop pattern of the Shale Grit (SG) within grid square 1183. [1]

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(ii) Evaluate the map evidence within grid square 1183 that suggests the Shale Grit (SG) is very gently dipping. [2]

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Total 7 marks

During the Lower Carboniferous the area covered by the geological map was part of a:

"...shallow-water lagoon, close to the equator, with a deeper water basin to the north. It was associated with small but active volcanic vents producing fluid lava".

(a) Outline the evidence that supports these conclusions from the geological map and generalized geological column. [3]

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(b) **Figure 5** is a field sketch of a vertical section of Apron-Reef limestone (**Rap**) at **grid reference 134834**. The section is **in situ**.

(i) Complete the chart below by measuring the dip of the limestone in Figure 5. 

<table>
<thead>
<tr>
<th>Dip of the limestone in Figure 5</th>
<th>degrees</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dip of the sediment infilling the shells</td>
<td>Horizontal - 0 degrees</td>
</tr>
</tbody>
</table>

(ii) Explain how the field data (Figure 5) supports the theory that the Apron-Reef limestone (**Rap**) was laid down on a slope rather than being tilted by later folding.  

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Total 6 marks
7. The mineral veins (rakes) are interpreted from field evidence as having been formed
"by hot mineralising fluids ascending along steeply inclined faults that appear to show strike-slip movement as well as vertical displacement."

(a) Refer to the geological map.
   (i) Describe the orientation and distribution of the mineral veins. [2]

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   (ii) Describe the map evidence to support the hypothesis that mineralisation was along 'steeply inclined faults'. [2]

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(b) Refer to the Oxlow Rake fault system within grid squares 1280 and 1380 on the geological map.
   (i) Measure the amount and state the type of horizontal displacement along the Oxlow Rake fault system. [2]

   Amount .......................(m)      Type ..............................

   (ii) Explain how field evidence might be used determine the actual direction of movement (slip direction) along the Oxlow Rake fault system. [2]

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   ........................................................................................................................................
   ........................................................................................................................................

(c) Using map evidence, assess the potential geological problems that might be associated with extraction of the minerals from these veins under the following headings. [4]

   Environmental issues ........................................................................................................
   ........................................................................................................................................
   ........................................................................................................................................

   Sustainability ....................................................................................................................
   ........................................................................................................................................
   ........................................................................................................................................

Total 12 marks
8. **Figure 6** is a section through the Mam Tor landslide along the line A - B on the **geological map**. Continued disturbance of the main A625 road, which crosses the landslide twice, made road maintenance unsustainable resulting in its closure in 1979.

![Figure 6](image)

Refer to the Mam Tor landslide (grid square 1383) and **Figure 6**.

(i) Complete the table below to describe the characteristics of the Mam Tor landslide. [3]

<table>
<thead>
<tr>
<th>Characteristics of the Mam Tor Landslide</th>
<th>Mam Tor Beds (MT) - sandstones</th>
</tr>
</thead>
<tbody>
<tr>
<td>Solid geology of cliff face</td>
<td></td>
</tr>
<tr>
<td>Solid geology beneath slip plane</td>
<td>•</td>
</tr>
<tr>
<td>Maximum length (along line A - B)</td>
<td>•</td>
</tr>
<tr>
<td>Maximum width (at 90° to line A - B)</td>
<td>550 m</td>
</tr>
<tr>
<td>Type of faults produced within the landslide</td>
<td>•</td>
</tr>
<tr>
<td>Original hillslope angle that failed.</td>
<td>30 - 35 degrees</td>
</tr>
</tbody>
</table>

(ii) Using evidence from the **geological map** and **Figure 6**, assess the contribution of water and geological structure in the location of the landslide. [4]
(iii) Using your knowledge and evidence from the data provided, assess the geological implications of reopening the A625 road to light traffic. You should make specific reference to the geological map and Figure 6 and focus on the measures that might be undertaken to:

1. monitor the landslide;
2. stabilise the slope.

Evaluate the likely success of the stabilising solutions and their sustainability.

[8]

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Total 15 marks
GEOLOGY – GL5

THEMATIC UNIT 1

QUATERNARY GEOLOGY

SPECIMEN PAPER

(1 hour)

ADDITIONAL MATERIALS

In addition to this examination paper, you may require a calculator

INSTRUCTIONS TO CANDIDATES

Write your name, centre number and candidate number in the spaces at the top of this page.
Answer the question from Section A and one from Section B.
Write your answers in the spaces provided in this booklet.

INFORMATION FOR CANDIDATES

The number of marks is given in brackets at the end of each question or part-question.

You are reminded that assessment will take into account the quality of written communication used in answers that involve extended writing (Section B).

No certificate will be awarded to a candidate detected in any unfair practice during the examination.
SECTION A

Answer question 1 on the lines provided in the question.

1. **Figure 1a** is a pollen diagram obtained by analysing core samples from a borehole through a lake deposit of Pleistocene age. **Figure 1b** is a microscopic view of a representative pollen sample from a layer (zone) within the lake sediments.

   **Figure 1a**

   - Upper Glacial Till
   - Lower Glacial Till
   - Lake sediments
   - Total pollen in sample

<table>
<thead>
<tr>
<th>Zone</th>
<th>Birch</th>
<th>Pine</th>
<th>Elm</th>
<th>Oak</th>
<th>Alder</th>
<th>Maple</th>
<th>Hornbeam</th>
<th>Spruce</th>
<th>Hazel</th>
</tr>
</thead>
<tbody>
<tr>
<td>7</td>
<td></td>
<td></td>
<td></td>
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<td></td>
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<td></td>
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<tr>
<td>6</td>
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<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

   (different scale)

   **Total number of pollen grains = 40**

   **Source:** Snowdon’s plants since the glaciers
   National Museum of Wales.

   **Figure 1b**

   - Birch Pollen grain
   - Pine Pollen grain
(a) Complete the chart by:

(i) identifying and counting the birch and pine tree pollen grains in the pollen sample (Figure 1b); [1]

(ii) expressing that the results of (i) as a percentage of the total number of grains in the pollen sample (i.e. 40). [1]

<table>
<thead>
<tr>
<th>Pollen type (Tree/non tree)</th>
<th>Species</th>
<th>Number of pollen grains</th>
<th>Percentage of total on slide</th>
<th>Percentage of tree/non-tree</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tree</td>
<td>Birch</td>
<td></td>
<td>30</td>
<td>30%</td>
</tr>
<tr>
<td></td>
<td>Pine</td>
<td></td>
<td></td>
<td>10%</td>
</tr>
<tr>
<td>Non-tree</td>
<td>Heather</td>
<td>4</td>
<td>10</td>
<td>10%</td>
</tr>
<tr>
<td></td>
<td>Sedges</td>
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<td>15</td>
<td>15%</td>
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<td>Total</td>
<td>40</td>
<td>100</td>
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</tbody>
</table>

(b) State from which zone, (1 – 7) in Figure 1a, the pollen sample (Figure 1b) was probably obtained. Explain your reasoning. [2]

Sample from zone, (1 – 7) ................................................................................................................

Explanation ...........................................................................................................................................
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(c) With reference to Figure 1a:

(i) describe the changes in dominance of tree pollen types with time; [3]
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(ii) describe the changes in climatic conditions that may be interpreted from an analysis of the pollen and sedimentary data during this part of the Pleistocene. State the evidence for your conclusions. [3]

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(d) Using your knowledge,

(i) outline two characteristics of pollen grains that make them useful in the study of climatic fluctuations during the Quaternary period, [2]

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(ii) explain how the climatic fluctuations identified in the borehole data might be confirmed from deep ocean sediments of the same age. [3]

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Total 15 marks
SECTION B

Answer one question from this Section on the following pages.

The marks you will be awarded in your essay take into account:
- evidence of geological knowledge and understanding;
- the use of geological examples;
- legibility, accuracy of spelling, punctuation and grammar;
- the selection of an appropriate form and style of writing;
- the organisation of material, and use of geological vocabulary, in the essay.

EITHER,

2. Using specific examples, explain how a study of the processes and products in a modern sedimentary environment enables the reconstruction of earlier environments recorded in sedimentary rock sequences. [25]

OR,

3. With reference to examples, describe how geological structures and bodies may produce different relief forms. You may wish to refer to your field observations. [25]

OR,

4. (a) Describe the nature, causes and erosional effects of turbidity currents commonly observed in modern aqueous environments.

(b) Discuss the origin of sedimentary features preserved in ancient turbidite sequences. [25]
GEOLOGY – GL5

THEMATIC UNIT 2

GEOLOGY OF NATURAL RESOURCES

SPECIMEN PAPER

(1 hour)

ADDITIONAL MATERIALS

In addition to this examination paper, you may require a calculator.

INSTRUCTIONS TO CANDIDATES

Write your name, centre number and candidate number in the spaces at the top of this page.
Answer the question from Section A and one from Section B.
Write your answers in the spaces provided in this booklet.

INFORMATION FOR CANDIDATES

The number of marks is given in brackets at the end of each question or part-question.

You are reminded that assessment will take into account the quality of written communication used in answers that involve extended writing (Section B).

No certificate will be awarded to a candidate detected in any unfair practice during the examination.
SECTION A

Answer question 1 on the lines provided in the question.

1. During burial in a subsiding basin, rock salt can rise up through the overlying sedimentary rocks to form salt domes, as shown in Figure 1a. Salt domes can produce traps for oil and gas.

(a) Give one reason why "rock salt can rise up through the overlying sedimentary rocks to form salt domes". [1]

...................................................................................................................................................

(b) (i) Name a potential reservoir and cap rock in Figure 1a and explain how the physical properties of each rock type enable oil and gas to be trapped. [4]

Reservoir rock ..............................................................................................................................

Relevant physical properties ........................................................................................................

...................................................................................................................................................

Cap rock ......................................................................................................................................

Relevant physical properties ........................................................................................................

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(ii) On Figure 1a use a labelled arrow (\(\triangle T\)) to show the location of a trap in which oil and gas could accumulate. Explain your answer. \([3]\) 

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(c) Figure 1b shows a graph of the local gravity anomaly profile obtained over the salt dome (between points \(A\) and \(B\)) in Figure 1a.

![Figure 1b](image)

The depth to the top of the salt dome can be calculated approximately from the formula:

\[ z = 1.73 \times \frac{x}{2} \]

Where  
\(z\) = depth (in kilometres) to the top of the salt dome.  
\(x\) = the horizontal distance (in kilometres) between the two points on the gravity profile at which the gravity anomaly is half the maximum amplitude (as shown on Figure 1b).

(i) Measure the size of the local gravity anomaly produced by the salt dome. \([1]\) 

............................................................................................................................. milligals

(ii) Calculate the depth to the top of the salt dome using the formula. Show your working. \([2]\) 

.............................................................................................................................kilometres
Choose one other appropriate geophysical survey method and describe how it could be used to obtain further details of the salt dome and the surrounding structures. [4]

Chosen geophysical survey method .................................................................

Description of use .................................................................................................................................

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Total 15 marks
SECTION B

Answer one question from this Section on the following pages.

The marks you will be awarded in your essay take into account:
evidence of geological knowledge and understanding;
the use of geological examples;
legibility, accuracy of spelling, punctuation and grammar;
the selection of an appropriate form and style of writing;
the organisation of material, and use of geological vocabulary, in the essay.

EITHER,

2.  (a) Describe the formation of coal deposits.

(b) Explain how environmental damage associated with the quarrying or mining of raw materials may be minimised. [25]

OR,

3.  Compare the formation of residual and precipitated economic deposits. [25]

OR,

4.  Evaluate the use of two of the following techniques in the exploration of mineral and / or energy resources:

(i) geological mapping;

(ii) geochemical prospecting;

(iii) satellite remote sensing; [25]
GEOLOGY – GL5

THEMATIC UNIT 3

GEOLOGICAL EVOLUTION OF BRITAIN

SPECIMEN PAPER

(1 hour)

ADDITIONAL MATERIALS

In addition to this examination paper, you may require a calculator

INSTRUCTIONS TO CANDIDATES

Write your name, centre number and candidate number in the spaces at the top of this page.
Answer the question from Section A and one from Section B.
Write your answers in the spaces provided in this booklet.

INFORMATION FOR CANDIDATES

The number of marks is given in brackets at the end of each question or part-question.

You are reminded that assessment will take into account the quality of written communication used in answers that involve extended writing (Section B).

No certificate will be awarded to a candidate detected in any unfair practice during the examination.
SECTION A

Answer question 1 on the lines provided in the question.

1. **Figure 1a** is a cross-section between Moreton-in-Marsh and the Mendip Hills. The Inferior Oolite (a division of the Jurassic) is divided into the Lower, Middle and Upper Inferior Oolite. **Figure 1b** shows simplified sedimentary logs of the Inferior Oolite and underlying rocks at the four locations shown. **Figure 1c** is a field sketch of a quarry at Vallis Vale in the Mendip Hills.

**Figure 1a**

**Upper Inferior Oolite** - yellow, oolitic limestone with worn and broken brachiopods. Horizontal bedding with conglomerate at the base. The conglomerate lies on a bored surface covered with bivalves.

**Carboniferous Limestone** - beds dipping at 40° North. Grey, massively bedded, shelly limestone with colonial corals in position of growth.
(a) Using Figure 1a and Figure 1c, name the type of boundary between the Upper Inferior Oolite and the underlying beds. Give one reason for your answer. [2]

Type of boundary ............................................................................................................
Reason …………………………………………………………………………………..………..
........................................................................................................................................

(b) Refer to Figure 1b.

(i) Measure the thickness of the Inferior Oolite sediments at Cheltenham and Vallis Vale. [1]

Cheltenham………m
Vallis Vale…………..m

(ii) Give two possible reasons for the difference in thickness between these two locations. [2]

(iii) ............................................................................................................................. ............
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(c) State the evidence from Figure 1a that indicates that there were earth movements after the deposition of the Middle Inferior Oolite but before the deposition of the Upper Inferior Oolite. [3]

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(d) (i) Using evidence from Figure 1c, describe two characteristics of the environment of deposition of the Upper Inferior Oolite at Vallis Vale. [4]

Characteristic .................................................................
Evidence .................................................................
............................................................................................................................. ............

Characteristic .................................................................
Evidence .................................................................
(ii) Contrast the environment of deposition of the **Carboniferous Limestone** and the **Upper Inferior Oolite** at Vallis Vale as shown in Figure 1c.

[3]

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**Total 15 marks**
SECTION B

Answer one question from this Section on the following pages.

The marks you will be awarded in your essay take into account:
- evidence of geological knowledge and understanding;
- the use of geological examples;
- legibility, accuracy of spelling, punctuation and grammar;
- the selection of an appropriate form and style of writing;
- the organisation of material, and use of geological vocabulary, in the essay.

EITHER,

2. The rocks in Britain show evidence of climatic change throughout the Phanerozoic. Evaluate the evidence in the rock record for major climatic change in Great Britain from the Carboniferous to the present day. [25]

OR,

3. (a) Explain how a study of the mineralogy, texture, sedimentary structures and fossil content of sedimentary rocks can be used to interpret the variation in palaeoclimate in Britain during the Permo-Triassic.

   (b) Evaluate the reliability of the evidence. [25]

OR,

4. Evaluate the following statement. 'Measurement and interpretation of the magnetic inclination in rocks and apparent polar wandering curves are techniques which can aid in the determination of Britain's palaeolatitude through time.' [25]
GEOLOGY – GL5
THEMATIC UNIT 4
GEOLOGY OF THE LITHOSPHERE

SPECIMEN PAPER

(1 hour)

ADDITIONAL MATERIALS

In addition to this examination paper, you may require a calculator

INSTRUCTIONS TO CANDIDATES

Write your name, centre number and candidate number in the spaces at the top of this page.
Answer the question from Section A and one from Section B.
Write your answers in the spaces provided in this booklet.

INFORMATION FOR CANDIDATES

The number of marks is given in brackets at the end of each question or part-question.

You are reminded that assessment will take into account the quality of written communication used in answers that involve extended writing (Section B).

No certificate will be awarded to a candidate detected in any unfair practice during the examination.
1. **Figure 1a** is a graph showing spreading rates for parts of the Atlantic and Pacific Oceans based on the distance of magnetic anomalies from the spreading ridge compared to the polarity reversal time scale for the last 4 Ma.

![Figure 1a](image)

Distance from ridge
to anomaly boundary (km)

(a) (i) Mark in **Box X** on **Figure 1a**, with an arrow labelled (← R), a period of time showing **reversed** polarity. [1]

(ii) State the distance from the Pacific ridge at which the 2 Ma anomaly boundary would be located. [1]

............................................................................................................................. ............

(iii) Explain how rocks of the ocean crust become magnetised with a reversed polarity. [3]

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(b) (i) Using Figure 1a, calculate the spreading rate (cm/year) of the South Pacific Ocean. Show your working.  

South Pacific spreading rate …………………………… cm/year

(ii) Using your knowledge, explain two other methods that can be used to calculate ocean spreading rates.

Method 1 ........................................................................................................................................
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Method 2 ........................................................................................................................................
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(c) **Figure 1b** is a map showing the main features of the Pacific and Atlantic ocean basins. The two oceans are considered to be at different stages in the J Tuzo Wilson cycle of ocean basin evolution.

Assess the evidence from **Figure 1a** and **1b** to determine which ocean (Pacific or Atlantic) shows the most advanced stage in ocean basin development. [4]

Ocean: .................................................................

Evidence: .................................................................

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Total 15 marks
SECTION B

Answer one question from this Section on the following pages.

The marks you will be awarded in your essay take into account:
  evidence of geological knowledge and understanding;
  the use of geological examples;
  legibility, accuracy of spelling, punctuation and grammar;
  the selection of an appropriate form and style of writing;
  the organisation of material, and use of geological vocabulary, in the essay.

EITHER,

2. Describe the major structural features of the continental lithosphere. Explain the origin of these features with reference to the theory of plate tectonics. [25]

OR,

3. Describe and explain how a study of earthquake body waves provides evidence for the variation in thickness and mechanical properties of the lithosphere and asthenosphere. [25]

OR,

4. (a) Describe the variation in surface heat flow across a spreading ocean basin and active continental margin.

   (b) Explain how surface heat flow relates to plate tectonic and mantle processes within the lithosphere. [25]
GL1

FOUNDATION GEOLOGY

MARK SCHEME

Range of acceptable answers
The answers given in the marking schemes in this Specimen Assessment Materials document are those that would be acceptable to the Chief Examiner. However, alternative answers that are correct and relevant to the question are to be given appropriate credit by markers.

1.   (a) Destructive/convergent/collision or subduction zone (1) [1]

(b)   (i) Two continental plates collide (1)
Lithosphere thickens to form mountains (1)
or equivalent e.g. folding, uplift, up-faulted [2]
(ii) Increase as collision and thickening continues (1)
Decrease as erosion occurs (1) [2]

(c)  (i) Foci located along subducting plate (1) [1]
(Also accept foci within the rising magma or on leading edge of non-subducting plate)
(ii) Friction (1)
Brittle deformation/compression (1)
Reference to subducting plate (1)
Moving against non subducting plate (1)
Release of stress, or pressure release (1)
Reference to role of rising magma (1)
(max 3) [3]

(d)  (i) Andesite (1) [1]
(ii) partial melting R (or explanation of it) (1)
of subducted/oceanic/basaltic plate (1) [2]

(e)   Reference to constructive/divergent plate boundary or sea-floor spreading (1)
Reference to plate movement direction
  e.g. plate moves north/east from ridge or away from ridge(1)
Reference to effect of plate movement on the X-Y boundary
  e.g. movement forces subduction/collision to (north/east) (1)
Credit other sensible answers
(3 max) [3]

Total 15 marks
2.  

(a)  
(i)  Mexico epicentre located  (1)  [1]  

(ii)  \[6600\text{km} = \frac{330\text{km min}^{-1}}{60} = 5.5 \text{ km s}^{-1}\]  
\[20\text{min} = 60\text{km} \]  
(1) method  (1) correct answer  
Avoid compounding errors  [2]  

(iii)  S-waves – shear waves  (1)  
S-waves are not transmitted through a liquid  (1)  
Liquids do not shear / rigidity  (1)  
Outer core is liquid  (1)  
Shadow-zone (103 -180 on surface opposite the epicentre) (1)  
Diagrams credited  (1)  
(3 max)  [3]  

(b)  
(i)  Asthenosphere correctly identified on graph  (1)  [1]  

(ii)  S-wave plotted correctly (1+1)  [2]  
Density correctly plotted (1 + 1)  [2]  

(c)  
(i)  Probable answers  
Give (1) + Explain (1)  
P waves speed up (1) more rigid/incompressible (1)  
Density increases (1) change from liquid to solid (1)  
(Must explain evidence given for second mark)  

Alternatives explained/reasoned  
Reflections from the inner core boundary into shadow zone (2)  
Reduction in arrival time/increase velocity of P waves that travel through inner core than would be expected if liquid (2)  
S waves are found in inner core - thus solid/not liquid as S waves only travel through liquids (2)  
(2 max)  [2]  

(ii)  Possible answers  (1+1 as above)  
Velocity of P waves corresponds to that identified in laboratory experiments using iron to simulating the inner core. (2)  
Earth's magnetic field requires an iron core (2)  
Mean density of Earth (5.4) implies a higher density core (2)  
Iron meteorites associated with planetary cores (2)  
(2 max)  [2]  

Total 15 marks
3.  

(a)  Lava flow (1)  
Concordant (1)  
One baked margin (1)  
Upper weathered surface (1)  
(3 max)  

(b)  
(i)  X - Mud crack/desiccation crack (1)  
(Accept solution/karstic feature)  
Y - Cross bedding/dune bedding. (1)  
(ii)  Limestone - Shallow marine lagoon (1)  
or Terrestrial/lake (1)  
carbonate - evaporites (1)  
low energy - fine grained (1)  
very shallow - mud cracks(1)  

OR  
Sandstone - Terrestrial - red oxidation (1)  
Wind dominated/arid/desert -  
rounded grains(1)  
well sorted grains(1)  
dune bedding (1)  

(Max 3 marks)  

(c)  Marble - Base of Lava B/limestone (1)  
Baked margin of lava flow/contact met. of limestone (1)  
(Max 2)  
Spotted rock - Lava A/shale (1) or Xenolith in Lava A (1)  
Baked margin of lava/contact met of shale (1)  
(Max 2)  

(d)  Must explain not just state-  
Baked margin on top of lava - not base(1)  
Weathered/erosion surface underneath lava - not on top (1)  
Included fragments of lava in mudstone/limestone - lava older (1)  
Shale xenoliths in lava A -shale older (1)  
Cross bedding is truncated at the bottom(1)  
Mudcracks point upwards(1)  
(Max 3)  

Total 15 marks
4. (a) Horizontal beds drawn on face Y (1)
   Explanation to include: (2)
   Beds are horizontal
   Beds dip into face Y
   Face Y is a strike section
   Face Y at right angles to dip direction of beds(face X
   (3 max) [3]

(b) (i) Axial Plane drawn in correct position dipping west [1]

(ii) Two of the following:
   anticlines and synclines
   asymmetrical or dip angles quoted
   angular hinges
   axes trend N-S [2]

(c) (i) Throw = 5.5m range 5.3 – 5.7m [1]

(ii) Reverse [1]

(d) (i) Igneous rock A has baked the limestone (Res)
   Igneous rock A = Sill intruded INTO the limestone
   Limestone must predate Igneous rock A
   (2 mark R +1) [2]

(ii) Igneous Rock A cut by fault
   Fault must post date –cross cutting relationships [2]

(iii) Beds are the right way up (graded bedding)
   Sandstone C is beneath Sandstone B (Superposition)
   Sandstone C predates Sandstone B [3]

Total 15 marks
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GL2a

INVESTIGATIVE GEOLOGY

MARK SCHEME

Range of acceptable answers
The answers given in the marking schemes in this Specimen Assessment Materials document are those that would be acceptable to the Chief Examiner. However, alternative answers that are correct and relevant to the question are to be given appropriate credit by markers.

SPECIMENS

A = granite (a "grey" porphyritic type e.g. from Cornwall, with large feldspar phenocrysts and a clearly visible ground mass – for use in Q1)

D = slate/shale with graptolites (must have clearly recognizable fossils – for use in Q4)

K = garnet crystal (a large enough crystal to test hardness – for use with Q3)

1. (a) Discordant (1)
   Dyke (1)  
   [2]

   (b) Drawing:
   Phenocrysts
   • size to scale (e.g. 15 - 20 mm) – larger than groundmass (1)
   • shape (good) (1)
   • alignment (random) (1)
   Groundmass
   • shape (poor) (1)  
   [4]

   (c) feldspar and mica
   • use hardness, colour or cleavage
   1 mark for each of naming, describing and the result. (3)

   feldspar and quartz
   • use cleavage only (but don't credit if used above)
   1 mark for each of naming, describing and the result. (3)  
   [6]

Total 12 marks
2.  
(a)  
(i) Elongate, (1) rounded (convex) upper surface, (1)
rounded (concave) lower surface (1)  
(max 2 marks)  
(ii) Pillows (1) 

(b)  
(i) Example of appropriate location/ (1) 
(ii) Description of planning as appropriate (2)
(e.g. Measurements, field sketch/photo, Grain-size etc) 
(iii) Explanation – Holistic to include:
Accuracy of title, scale, measurements, quality of sketches etc
(max 5 marks) 

[Teacher will have better idea of value of answer in (b) given their involvement with the individual fieldwork/teaching]

Total 11 marks

3.  
(a)  
(i) Sorting moderate/good (1)
Shape rounded (1) 
Size coarse (1) 

(ii) Sorting 
• moderate/good is ok for fluvial but would expect better from aeolian 
Shape  
• rounded is ok for both but would aeolian produce discs? 
Size  
• ok for river with a flood discharge but too large for aeolian 
(2 marks each characteristic chosen if evaluated– max 4 marks) 

(b)  
(i) Reference to mica or foliation (credit garnet) (1) 
(ii) Schist (1) 
(iii) Mechanical/physical weathering/freeze-thaw 
(iv) Hardness test – description including use of steel pin (1)
Not scratched by steel pin – harder than 5.5 (1) 
Crystals stand "proud" of surface (1) 
(3 max)

Total 13 marks
4.  

(a)  

(i) Correctly positioned (E-W within Rock Unit C) and labeled  

(ii) Symmetrical is **false**  

   • limbs have an unequal width in outcrop despite level surface (therefore have different dips)  

Syncline is **false**  

   • oldest beds outcrop in centre of fold  

   (credit if answer refers to overturned anticlines!)  

DO NOT CREDIT REASON IF EVALUATION IS INCORRECT  

(b)  

(i) different trends E-W (units CDE) vs NW – SE  

   different wavelengths shorter/200m (units CDE)  

   (1)  

(ii) Rock Unit D:  

   • Graptolite  

Rock Unit F:  

   • Ammonite  

   Lower Palaeozoic  

   Mesozoic  

   (1)  

Total 9 marks

5.  

Pluton (Rock Unit A) and X-cutting F/G  

F/G at correct dip to SW of F2  

F2: vertical dip and labeled; correct movement (upthrow to SW)  

F3: vertical dip and labeled; correct movement (upthrow to SW)  

Base of Rock Unit J (unconformity) at correct dip and X-cut F2/F3  

Rock Unit B within J at correct dip  

Folds between F2 and F3:  

   • Antiform axis northeast of F2: vertical; labelled  

   • Synform axis southwest of F3: vertical; labelled  

   • 3 Limbs at correct dip (1 per limb)  

Rock Unit F drawn to correct thickness between F2/F3  

Label Rock Unit G beneath F between F2/F3 (or NE F3).  

A completed, marked cross-section will be issued with the mark scheme  

Total 15 marks
## MARK SPECIFICATION GRID

### GCE GEOLOGY

**UNIT TEST**

**Year of Examination Specimen**

**Session:** summer/winter

<table>
<thead>
<tr>
<th>AS Unit __ GL2a ____</th>
<th>Assessment Objective</th>
<th>Paper Total Mark</th>
<th>Other requirements</th>
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<tr>
<td>Raw Totals</td>
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</tbody>
</table>
Range of acceptable answers

The answers given in the marking schemes in this Specimen Assessment Materials document are those that would be acceptable to the Chief Examiner. However, alternative answers that are correct and relevant to the question are to be given appropriate credit by markers.

1. (a) Crater/vent (1)  
    Initial (steam/ash) explosive activity (1) 
    (2 max)  [2]

(b) Harmonic tremors/long duration/low amplitude (1)  
    Confined pattern/fingerprint (1)  
    Large number (1)  
    Movement and/or intrusion of magma (1)  
    (3 max)  [3]

(c) (i) Pressure from magma (1)  
    Over-steep/critical angle of slope (1)  
    Vibration - earthquakes (1)  
    Other sensible  
    e.g. Heated/expanded groundwater-lubrication (1)  
    (2 max)  [2]

    (ii) Landslide (1) released pressure (1) triggering a  
    Lateral blast (1)  
    Debris flow (1)  
    To north (1)  
    New lava dome (1)  
    (3 max)  [3]

(d) Techniques commonly used include  
    Electronic distance measurement using a laser light source (EDM);  
    Measurement of tilt, (electronically and by triangulation)  
    Standard levelling surveys to obtain elevation changes.  
    Measuring crack openings  
    Measuring changes in water level around a crater lake.  
    (2 max for ONE described)  [2]

Total 12 marks
2. (a) (i) A - decreases
B - increases (1)

(ii) 1959 - 0 cm
1969 - +20 cm (1)
20cm/10years = +2cm/yr (1) [2]

(iii) C - little/no significant change in length (1)
C - both ends of survey line on same fault block (1)
B - crosses the fault/extension (1) [3]

(b) Arrows showing dextral strike slip (1)
D - shows extension over time (1) [2]

(c) Reduction in extension or compression along a survey line (1)
shows build up of stress (1)
Seismic gap (1)
Some move faster than others (1)
Thus increase chance of an earthquake (1)
(Max 2 marks) [2]

(d) One explained from:
groundwater levels/pressure
tilting/ground elevation
radon gas emissions
electromagnetic signals
electrical resistivity
earthquake lights
changes in seismic activity.
Other appropriate explained (Max 3 marks) [3]

Total 13 marks
SECTION B

To ensure comparability across all answers involving extended writing, mark band criteria are applied holistically to every essay answer before determining a final mark. The table containing the criteria is found below Q5.

Essays are marked both on their geological content and their quality of written communication (QWC). The mark band criteria include three strands of QWC which require that candidates

(i) ensure that text is legible and that spelling, punctuation and grammar are accurate so that meaning is clear;
(ii) select and use a form and style of writing appropriate to purpose and to complex subject matter;
(iii) organise information clearly and coherently, using specialist vocabulary when appropriate.

3. (a) Describe, giving reasons, the geological factors that need to be considered in the disposal of highly toxic and/or radioactive waste compared with the disposal of domestic waste. [15]

Nature of toxic and radioactive waste. Can do either or both (depth v breadth)
Length of time unstable, half life - millions of years. Degree of hazard/danger to life
Examples of chemicals (e.g. cadmium, mercury, heavy oils, acids) and radioactive waste (e.g. spent uranium rods - low and high level).
Needs to be in long term site - often buried.

Nature of domestic waste - Can be inert (building rubble) or produce leachate on breaking down. Leachate defined.
Disposal in surface landfill site - Limited time span - ~25 years

Both require
- Site capable of retaining waste - but for different times
- Free from disturbance (tectonic or subsidence).
- Topography and structure - Existing hole/quarry - stable slopes - mainly landfill
- Lithological characteristics - bedrock and surface geology - Impermeable rock base to site
Domestic - clay with low permeability rates for leachate containment or artificial Geomembrane
Toxic - confinement in hard crystalline stable rock - deep.
- Hydrological regime - Dry site - above water table is preferred- (pore pressure)
  Gradient and rate of groundwater flow. Proximity to groundwater extraction.
- Careful monitoring of hydrological system – wells outside landfill

Differences
Domestic factors involve - consideration of near future - methane hazards, subsidence of waste, leachate management system.
Toxic factors involve - consideration of long future changes - erosion (ice, sea level change), tectonic activity.
(Holistic - Max 15)
(b) With specific reference to one actual (or potential) landfill or underground site, analyse the suitability of the site for the type of waste disposed. [10]

Holistic - depends upon site and type
Case studies credited. E.g. Sellafield or local landfill site.
Examples of suitable -
  Lithologies, Clay or rock - permeability
  Groundwater/site characteristics.
  Engineering practice
  Clay lining by compaction of clay, plastic/geomembrane
  Venting of methane gas – boreholes within the landfill
  Leachate management system – porous pipes for removal/recycling of leachate

Holistic (max10) (Max 7 if no case study)

Total 25 marks

4. Using one or more case studies,

(a) describe the extent to which the destructive effects of lava flows might be controlled. [10]

Discussed using examples. Ultimately little management/control if people choose to live near volcanoes.
Case studies - Iceland, Etna etc. NO CASE STUDIES (MAX 7)
Evacuation, hazard mapping, diversion/blocks, dropping-spraying with water, explosion of flow margin, prediction devices.
(10 marks)

(b) explain the difference in the hazards typically associated with the eruption of
(i) basaltic and
(ii) andesitic magmas [15]

Different magmas have different characteristics that affect viscosity
Nature of hazard depends upon composition, viscosity and gas content.

(i) Basaltic - mafic and Non viscous
  - gas readily escapes – not explosive (red volcanoes)
  - less ash – localised hazard
  - Fluid lava main hazard- Fast moving (initially few Km/hr)
  - Fire fountains
  - flows further - more hazard to property on lower slopes.
  - hotter initially (1000 degree)
Examples. (Nyirongongo, Iceland, Hawaii, Nyos, Columbia etc.)

(ii) Andesitic – intermediate and Viscous magma
  - gas does not easily escape – explosive (grey volcanoes)
  - bombs
  - Blast hazard
  - Much ash/bombs – worldwide effect
  - Pyroclastic flows
  - Lava slow moving (10's m/hr to few m/day)
  - associated with lahars.
  - Tsunamis
  - landsides
Examples (Pinatubo, Mt St Helens, Vesuvius, Krakatoa etc)

Total 25 marks
5. (a) Describe how the foundations of large structures can be affected by:

- unstable patterns of geological structures (e.g. bedding, jointing, faulting, cleavage);
- depth to the water table and rockhead. [15]
- Unstable patterns of geological structures (e.g. bedding, jointing, faulting, cleavage);
  Effect of dip of beds/cleavage.
  Slope faces daylight.
  Stable friction angles.
  Fracturing of fault planes.
  Density of joints.
  Lubrication by water.
  Case studies.
- Depth to the water table and rockhead.
  Affect of water on stability - porosity v permeability.
  Pore pressure, lubrication, rock type, liquefaction in earthquake prone areas.
  Effect of fluctuating water tables e.g. London.
  Rockhead depth - defined.
  Nature of the drift material on stability.
  Need for high foundation strength.
  Case studies.

(b) Explain how marine erosion and deposition may be influenced by civil engineering work in coastal areas. [10]

Erosion & depositional processes (e.g. longshore drift) described
Engineering activities may include:
Groynes, breakwaters, harbours, seawalls, rip-rap, slope drainage and reprofiling etc. Examples credited.

Cliff erosion is slowed by groynes/seawalls/rip rap etc which
Protect base of cliff from undercutting preventing release of sediment
Provide stability e.g. toe of landslide etc - loss of potential sediment source.
Increases the size of the beach - reduces energy of waves in engineered area
This results in changes in longshore drift pattern as:
Reduction in amount of sediment available
Reduction in deposition in unprotected parts of the coast
Results in increased marine erosion in unprotected area
Diagrams and Examples given credit.

Total 25 marks
## MARK BAND CRITERIA FOR GL3 ESSAYS.

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<tr>
<th>Summary Description</th>
<th>Mark out of 25</th>
<th>Criteria</th>
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<tbody>
<tr>
<td><strong>Excellent</strong></td>
<td>21 - 25</td>
<td>Not the perfect answer but purposeful, demonstrating a secure grasp of knowledge and understanding with few significant omissions. Well-supported and illustrated with detailed examples selected from named geological situations. The text contains few errors in spelling, punctuation and grammar. Complex ideas are expressed fluently and coherently with an appropriate style. Full use is made of geological terminology.</td>
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<tr>
<td><strong>Good/Very good</strong></td>
<td>16 - 20</td>
<td>Sound answers with relevant material providing evidence of good knowledge and understanding. May be limited in terms of supporting material and breadth of coverage but appropriate examples selected. There are only occasional errors in spelling, punctuation and grammar in the text which follows a purposeful, logical form. Ideas are expressed with clarity. Good use is made of geological terminology.</td>
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<tr>
<td><strong>Modest/Quite Good</strong></td>
<td>11 - 15</td>
<td>A reasonably secure grasp of basics but some deficiencies in knowledge and understanding. Examples and illustrations may lack detail or may not relate to real geological situations. The text shows adequate spelling, punctuation and grammar. The form and style of writing reflects the demands of the question with organisation of the geological material apparent. Reasonable use of geological vocabulary</td>
</tr>
<tr>
<td><strong>Weak/Minimal</strong></td>
<td>6 - 10</td>
<td>Answers show limited basic knowledge and understanding. Superficial use of geological examples. Deficiencies in communication are evident. Weaknesses in spelling, punctuation and grammar are apparent with some illegibility. Answers lack directness and organisation; there is a tendency to rehash prepared material and answer by inference. The geological vocabulary used is often misunderstood.</td>
</tr>
<tr>
<td><strong>Very weak</strong></td>
<td>1 - 5</td>
<td>Little evidence of knowledge and understanding with erroneous or repeated material evident. Communication skills poor, with spelling, punctuation and grammar errors intrusive. Text may not be legible. The candidate does not address the question. The answer may be too brief and contain little geological vocabulary.</td>
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</tbody>
</table>

N.B. Where students fail to write fully and fluently in continuous prose, a maximum mark of 19 out of 25 will be awarded.
## MARK SPECIFICATION GRID

**GCE GEOLOGY**

**UNIT TEST**

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**Session:** summer/winter

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### Assessment Objective

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GL4

INTERPRETING the GEOLOGICAL RECORD

MARK SCHEME

SECTION A

Range of acceptable answers
The answers given in the marking schemes in this Specimen Assessment Materials document are those that would be acceptable to the Chief Examiner. However, alternative answers that are correct and relevant to the question are to be given appropriate credit by markers.

1. (a)  
   (i) Vertebra (1) support, attachment of muscle etc (1) (max 2 marks) [2]
   (ii) Horns - defence - by moving tail it used it as a club. (1) Plates - temperature regulation (blood pumped though) defence, mating etc. (1) (max 2 marks) [2]
   (iii) Skull/brain too small for carnivore (1) Beak/small teeth - not designed for meat- only vegetation (1) Pelvis is Ornithischian- only plant eaters (1) Lumbering - not built for speed (1) Plates possible for protection/not carnivore (1) (max 3 marks) [3]

(b)  
   (i) Dinosaur Hind foot length (FL) Stride length (SL) metres metres (h = 4 x FL) Gait (running, trotting, walking)

<table>
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<tr>
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<th>FL</th>
<th>SL</th>
<th>(h = 4 x FL)</th>
<th>Gait</th>
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<td>0.23</td>
<td>2.60</td>
<td>0.92</td>
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<td>B</td>
<td>0.35</td>
<td>2.1</td>
<td>1.40</td>
<td>Walking</td>
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</table>

   (ii) Quadruped/Number of feet - consistent
   Digits on hind foot - consistent
   Hind print/hip height -too small
   Too few digits on front foot
   Stride length - can't tell (depends on gait/speed)
   Other - e.g. could be a juvenile form of species
   (Holistic - max 4 marks for evaluation) [4]

Total 15 marks
2. (a) Anorthite (Calcium rich) (1)

(b) | Melt P | Temperature of melt (°C) | Composition of melt (% Na: % Ca) | Composition of crystals (% Na: % Ca) |
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<tr>
<td>35% Na : 65% Ca</td>
<td>1500 (+/-2)</td>
<td>35:65</td>
<td>10:90 (+/-2)</td>
</tr>
<tr>
<td>Initial crystallisation</td>
<td>1400</td>
<td>65:35 (+/-2)</td>
<td>25:75</td>
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<tr>
<td>Crystallisation at 1400°C</td>
<td>1350 (+/-2)</td>
<td>35:65 (+/-2)</td>
<td></td>
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</table>

(c) (i) zone I (more Anorthite/calcic-rich)
zone II (more Albite/sodic-rich) (1)

(ii) Ca higher melt point/Ca-rich first to crystallise (1)
solid solution series (1)
Temp drops too fast for equilibrium to be maintained (1)
Crystals unable to completely react back with melt/equilibrium (1) RES
Before more Na-rich crystals form around older crystals (1)
Process continues until crystallisation complete (1)
(Max 3 marks – R +2)

(d) Fine grained groundmass (porphyrytic texture) (1)
Crystallisation was too fast - rapid cooling. (1)
Ca removed/not left (1)
Not enough time for reacting back with melt - diffusion of ions (1)
(Max 2)

(e) Contamination during magmatic intrusion (1)
Xenoliths (1)
Magmatic stoping (1)
Example - peridotite in basalt, mafic rock in granite.(1)
Gravity differentiation/cumulates/gravity settling/
fractional crystallisation/or gravity layering (1)
Eg. Olivine first to crystallise (high crystallisation temp)(1)
Reference to position in Bowens Reaction Series (1)
Olivine more dense than other feldspar/augite (1)
Olivine sinks in liquid magma (1)
Olivine trapped at chilled margins/unable to differentiate (1)
(Max 3 marks)

Total 15 marks
3. (a) (i) Fault characteristics Description

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<tr>
<th>Fault characteristic</th>
<th>Description</th>
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<td>Strike direction</td>
<td>• E - W (1)</td>
</tr>
<tr>
<td>Downthrow direction</td>
<td>• North (1)</td>
</tr>
<tr>
<td>Amount of strike-slip movement</td>
<td>None</td>
</tr>
<tr>
<td>Principal stress component (σ) (parallel to strike direction)</td>
<td>• σ intermediate (1)</td>
</tr>
<tr>
<td>Type of fault</td>
<td>• Normal/tensional (1)</td>
</tr>
</tbody>
</table>

(ii) Shale - offset to East only (1)
Dyke - no offset (1)
e.g.

(b) (i) Number/Coarse (1), angular fragments (1), poor sorting(1), parallel alignment of clasts (1)
fault breccia/(cata)clastic texture/fragmental (1).
(Max 3 marks)

(ii) Brittle fracture (1) of competent limestone (1)
Shale is incompetent (1) 1 RES for competency
Ductile (plastic deformation) when subjected to stress (1)
(Max 2 marks – R +1)

(c) (i) Slickensides (or appropriate) (1)

(ii) Direction of grooves shows orientation of movement. (1)
(Credit smooth feel in direction of movement) (1)
Assessment: (1 RES)
Not always clear in which of two possible directions (1)
Reactivation possible (1)
Slickensides only record the LAST direction
of fault movement (1)
(Max 3 marks – R+2)

Total 15 marks
4. 

(a)  
(i)  \( E = \text{Precambrian} \) (1) 
(ii) \( I = \text{Carboniferous} \) (1)  

(b)  
(i) \( \text{Perm/Trias} \) (1)  
(ii) \( 400 - 200 = 200 \) (1) method 
\( \frac{200}{400} \times 100 = 50\% \) (1) answer  

(c)  
(i) \( \text{Cret/Tertiary boundary} \) (1)  
(ii) \( \text{Dinosaurs} \) (1)  
\( \text{Ammonites} \) (1)  
(Credit appropriate alternatives) (2)  
(iii) \( \text{Two outlined from:} \)  
\( \text{Sea level variations} \) (2)  
\( \text{Climatic change} \) (2)  
\( \text{Vulcanicity} \) (2)  
\( \text{Meteorite impact} \) (2)  

(d)  
Life with hard parts had not yet developed/soft bodies. (1)  
Unfavourable preservation (1)  
Only Algae, bacteria and medusoids/ (1)  
Life was scarce - less chance of preservation (1)  
Fossils destroyed with time  
(metamorphism, igneous activity, s'face processes) (1)  
Fossils not yet found (1)  
Fossil evidence is biased (1)  
(3 max)  

Total 15 marks
SECTION B

5. (a) Irregular, discontinuous, narrow band etc. (max 2 marks)

(b) 1 - Unconformity- dip difference/dip beneath (1)
2 - Head cross cut by landslide (1) (max 2 marks)

(c) (i) Describe - V'ing to east (1) interdigitating beds (1)
(max 1 mark)

(ii) Evaluate - mainly sub-parallel with contours (1)
outcrop conforms to the topography (ridge) (1)
Lacking dip arrows/east dipping arrow (1)
Accept - sometimes discordant to contours (1)
dip arrow of 25 degrees at V. (1) (max 2 marks)

Total 7 marks

6. (a) Limestone, Coral reef – shallow, warm (1 R plus 1)
Volcanic vents/lava flows/intrusions (1R plus 1) (max 3 marks)

(b) (i) Dip - 35 degrees (1)

(ii) Shells/sed. infill formed prior to lithification (1)
Sediment unaffected/zero dip. (1)
Reference to 'reef talus slope' (1) (max 2 marks)

Total 6 marks
7. (a) (i) NE-SW strike/trend (1)
sub-parallel veins (1)
mainly confined to limestone (1)
(max 2 marks) [2]

(ii) thin (1)
straight/linear structures = steep dip (1)
similar NE-SW trends (1)
that sometimes offset beds (1)
(max 2 marks) [2]

(b) (i) Amount - 175m (160m - 190m) (1)
Type - dextral (right handed) (1)
(max 2 marks) [2]

(ii) Slickenside orientation (1) Explained (1)
Vertical bed displacement (1) Explained (1)
(max 2 marks) [2]

(c) Holistic
Environmental– heavy mineral pollution (surface/groundwater),
waste tips, flooding
Sustainability - steep dip, thin vein, stability, amount of gangue,
subsidence
(max 2 marks from each) [4]

Total 12 marks
8. (i) Solid geology beneath slip plane

<p>| | |</p>
<table>
<thead>
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<tbody>
<tr>
<td>Maximum length</td>
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<td>(along line A - B)</td>
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<tr>
<td>Type of faults produced</td>
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<td>within landslide</td>
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<td>Edale shales (1)</td>
<td>975m</td>
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<tr>
<td>(950 - 1000m) (1)</td>
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<td>normal (1)</td>
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</table>

(ii) Holistic

Original angle over critical angle
spring lubrication
fault - vibration
Edale shales - incompetent base, impermeable pore pressures in sandstone/shale weathering/loading etc.

Must be supported with evidence from map/figure (max 4 marks)

(iii) Holistic: Credit use of the map and Figure 6 to give locations, references etc where possible for the following:

1. Monitor - mechanics of mapping, air photo-satellite imagery,
surveying, measurement of creep, strain,
groundwater pressures, instruments used

   (min 2R, max 6 marks).

2. Stabilise anchors - expensive
drainage - cheapest option
regrading slope - expensive
toe support - cheaper option
piles to stabilise slip - expensive
road on pile - expensive

Evaluation for max marks - visual impact, expense, inevitable slide.

   (min 2R, max 6 marks)
   (max 8 marks)

Total 15 marks
### GCE GEOLOGY

**UNIT TEST**

**Year of Examination** Specimen

**Session:** summer/winter

#### MARK SPECIFICATION GRID

<table>
<thead>
<tr>
<th>Question Number</th>
<th>Specification Reference</th>
<th>AO1</th>
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GL5

THEMATIC UNIT 1

QUATERNARY GEOLOGY

MARK SCHEME

Range of acceptable answers
The answers given in the marking schemes in this Specimen Assessment Materials document are those that would be acceptable to the Chief Examiner. However, alternative answers that are correct and relevant to the question are to be given appropriate credit by markers.

1. (a) (i) Birch = 7 – 17.5% (1) [1]
   (ii) Pine = 5 – 12.5% (1) [1]

(b) Zone 1 or 2 (1)
   Only zone with pine and birch alone (1)
   proportion of pollen correlates with sample (1)
   (2 max) [2]

(c) (i) birch and pine initially (1)
   gives way to mixed oak, hazel, maple (1)
   finally reduction in these to give dominance of birch and pine (1)
   Also accept
   Basic description of increase and decrease in tree pollen
   If further qualification with %ages
   Or description of proportions related to zones
   Or further detailed descriptions
   (max 3 marks) [3]

(ii) Birch/pine - cooler conditions of post glacial period. (1)
    Mixed forest - warmer at a height of interglacial (1)
    Birch/pine - return to cooler conditions at onset of glacial advance (1)
    Boulder clay (upper and lower) indicates colder conditions (1)
    Lake - warmer fluvial conditions (1)
    (max 3 marks) [3]

(d) (i) Plentiful - increased chance of preservation (1)
    Widespread - wind borne (1), easily identifiable (1),
    easily preserved – small (1), Climatically dependent (1)
    (Max 2 marks) [2]

(ii) Discussion of $^{18}O/^{16}O$ ratios in shells of marine animals and their explanation
    in terms of glacial and interglacial periods.
    $^{18}O/^{16}O$ trapped in carbonate shells
    As the temperature falls $^{18}O/^{16}O$ ratio increases (less $^{16}O$)
    $^{18}O$ is heavier than $^{16}O$
    Thus more $^{16}O$ is evaporated from sea during interglacials
    but returns via water cycle so ratio of $^{18}O/^{16}O$ during interglacial his
    constant.
    During glacial $^{16}O$ is prevented from returning to sea as it is locked up in ice.
    Thus ratio of $^{18}O$ Ind C water increases at during the colder glacial period.
    (Max 3 marks) [3]

Total 15 marks
SECTION B

Essays are marked both on their geological content and their quality of written communication [QWC]. To ensure comparability across all answers involving extended writing, mark band criteria are applied holistically to every essay answer before determining a final mark. The table containing the criteria is found after Q.4.

2. Essay depends upon field experience - must be **PROCESSES** and **PRODUCTS** in **MODERN** environment related to an ancient sedimentary sequence.

Description of the products relating characteristic features to process

Depth v breadth – Credit for real field observations.
If rubric not followed (e.g. not modern/purely descriptive and not linked to process–
Maximum mark (15)

Expect some of

(a) bed geometries(channel fill etc) and lithologies (sand silts muds)
(b) sedimentary structures (bedforms – ripples, bedding, desiccation crack etc)
(c) organic forms (shells, burrows, trails)
(d) field relations (way-up criteria, cross cutting relationships etc)
   linked to *modern* sedimentary processes.
   Holistic approach. Breadth v depth.
   Credit field observations

   **Total 25 marks**

3. Structures – sedimentary and/or tectonic

Answer depends upon field and other examples.
Must give a minimum of two landforms associated with structures and geological bodies (e.g. igneous, faults, folds etc.)
Major or minor scale accepted (i.e. fold mountains or baked margin effects.)
Credit field and other diagrams.

Examples
- fault scarp
- igneous body (batholith/ dyke/sill)
- folded rocks - breached anticline (Weald), inverted relief (Snowdon)
- Basin and Range topography
- Flood Basalt Traps
- Volcanic cones
- Small scale – e.g. Lulworth Cove
- Waterfalls
- Coastlines
- Fold Mountains/other large scale

Structures and bodies – Holistic

Care on glacial erosion features – not valid
Glacial deposition features (drumlins, kettle holes, moraines –credit)
(Quality of case study)

   **Total 25 marks**
4. (a) Nature - Submarine density current that forms a slurry of sediment slightly more dense than the surrounding sea. Flows far (continental shelf to abyssal plain) e.g. Grand Banks

Causes - Submarine slope failure associated with tectonic activity (earthquakes/volcanic activity). Unconsolidated/partly consolidated sediment on shelf typically becomes unstable and flows. Upward force of water (turbidity) keeping the sediment in suspension until energy is dissipated.

Erosional effects
Large scale Submarine canyons e.g.
Scale scale fluting of underlying sediments (turbulent action of flowing current plus sedimentary load.) - flutes (eddies), grooves, prod and bounce marks (tool marks)

(13 max)

(b) Minimum of two features discussed from:

Graded Beds/fining up sequence (Bouma sequence)
Sole structures - Flute/groove casts, bounce/prod marks preserved.
Load cast/flame structures.
Trace fossils - burrows/feeding trails

Credit examples, field diagrams etc.
Depth v breadth
(12 max)
Holistic approach to both sections.

Total 25 marks
# MARK BAND CRITERIA FOR GL5 ESSAYS

<table>
<thead>
<tr>
<th>Summary</th>
<th>Marks out of 25</th>
<th>Geological Criteria</th>
<th>Quality of Written Communication</th>
</tr>
</thead>
<tbody>
<tr>
<td>Outstanding</td>
<td>25-23</td>
<td>Not the perfect answer, but a candidate could not be expected to produce better work at this level in the time allowed.</td>
<td>The text contains few errors in spelling, punctuation and grammar. Complex ideas are expressed fluently and coherently with an appropriate style. Full use is made of geological terminology.</td>
</tr>
<tr>
<td>Very good</td>
<td>22-20</td>
<td>Irrefutable evidence of a thorough grasp of concepts &amp; principles. Arguments are well supported and balanced. A hint of flair apparent in the work.</td>
<td></td>
</tr>
<tr>
<td>Good</td>
<td>19-17</td>
<td>The answer is direct &amp; explicit showing the ability to use knowledge &amp; understanding &amp; to discuss. It may be limited in terms of supporting material &amp; breadth of coverage.</td>
<td>There are only occasional errors in spelling, punctuation and grammar in the text which, at the top end follows a purposeful, logical form. The quite good answer may show some slight deficiencies in directness &amp; organisation. Ideas are expressed with clarity. Good use is made of geological terminology.</td>
</tr>
<tr>
<td>Quite good</td>
<td>16-14</td>
<td>Shows a reasonably secure grasp of the basics, but answer may show some slight deficiencies in terms of knowledge &amp; understanding.</td>
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<tr>
<td>Modest</td>
<td>13-11</td>
<td>Material is mainly relevant and sound, but points need more development and support.</td>
<td>The text shows adequate spelling, punctuation and grammar. The form and style of writing reflects the demands of the question with organisation of the geological material apparent. However, the answer could take a more direct and explicit approach. Reasonable use of geological vocabulary.</td>
</tr>
<tr>
<td>Minimal</td>
<td>10-8</td>
<td>Work impoverished by limited knowledge &amp; understanding; tendency to rehash prepared material &amp; to answer by inference. Answer rather hit &amp; miss.</td>
<td>Deficiencies in communication are evident. Weaknesses in spelling, punctuation and grammar are apparent with some illegibility. Answers lack directness and organisation. The geological vocabulary used is often misunderstood.</td>
</tr>
<tr>
<td>Weak</td>
<td>7-5</td>
<td>Little evidence of knowledge or understanding; unable or unwilling to address the question; essentially random in approach.</td>
<td>Communication skills poor, with spelling, punctuation and grammar errors intrusive. Text may not be legible. The candidate does not address the question. The answer may be too brief and contain little geological vocabulary.</td>
</tr>
<tr>
<td>Very weak</td>
<td>4-1</td>
<td>Largely irrelevant; too brief; abundant erroneous material.</td>
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<tr>
<td>Unacceptable</td>
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<td>Wholly irrelevant or nothing written.</td>
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N.B. Where students fail to write fully and fluently in continuous prose, a maximum mark of 19 out of 25 will be awarded.
**Synoptic**

This test uses techniques, concepts and theories relevant to geology to assess the ability to apply knowledge understanding and skills acquired in other parts of the course to a theme that shows the interconnections between different facets of geology. It necessitates that students identify the appropriate material required for an answer. Other tests may incorporate different geological techniques, concepts and theories.

Specifically in this test: fossils; sediments; climate change; geological structures; uniformitarianism are involved in the assessment of Quaternary Geology.

**Quality of written communication**

The mark band criteria found in the Section B mark scheme are applied to every essay question before determining a final mark. To ensure comparability across all answers involving extended writing these mark band criteria are applied holistically to each essay. Essays are marked both on their geological content and their quality of written communication [QWC]. The mark band criteria include three strands of QWC which require that candidates:

(i) ensure that text is legible and that spelling, punctuation and grammar are accurate so that meaning is clear;

(ii) select and use a form and style of writing appropriate to purpose and to complex subject matter;

(iii) organise information clearly and coherently, using specialist vocabulary when appropriate.
GL5

THEMATIC UNIT 2

GEOLOGY OF NATURAL RESOURCES

MARK SCHEME

Range of acceptable answers

The answers given in the marking schemes in this Specimen Assessment Materials document are those that would be acceptable to the Chief Examiner. However, alternative answers that are correct and relevant to the question are to be given appropriate credit by markers.

1. (a) Lower density than surrounding rocks. (1) [1]

(b) (i) Reservoir rock - Sandstone (1)
Relevant Physical Properties - porous / permeable (1)
- connected pore spaces/allow to flow through (1)

Cap rock
Salt or shale (1)
Relevant Physical Properties - impermeable (1)
(max 2+2) [4]

(ii) Correct position of labelled arrow ←T (in a sandstone bed in fault trap, anticline trap or salt dome trap) (1)

Explanation of trap in terms of trap shape, and cap above reservoir (2 max)

<table>
<thead>
<tr>
<th>Name of Trap</th>
<th>Explanation examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fault</td>
<td>Impermeable cap rock faulted (1) against reservoir rock to collect oil/gas which has migrated up to this point so that oil/gas cannot by-pass it (1)</td>
</tr>
<tr>
<td>Anticlinal fold</td>
<td>Impermeable cap rock bent in anticline fold shape (1) to collect oil/gas which has migrated up to this point so that oil/gas cannot by-pass it (1)</td>
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<tr>
<td>Salt dome</td>
<td>Salt dome has risen and deformed surrounding rocks (1), impermeable cap rock arranged to collect oil/gas which has migrated up to this point so that oil/gas cannot by-pass it (1)</td>
</tr>
</tbody>
</table>

3

(c) (i) 18 milligals (1) [1]

(ii) $z = 1.73 \times \frac{2}{2}$ (1) Range 2-2.3

$z = 1.73\text{km}$ (1) Range 1.73km – 2km [2]
(d) Holistic:
seismic surveys (reflection/refraction)
shock waves reflected off geological boundaries
computerised maps created/ 3D pictures
seismic velocities.
velocity of shock wave through rock decreases with fracturing
(Boreholes - limited credit - since one borehole does not give surrounding
structure details, mostly used for rock detail, not structure detail)
Credit examples referenced
(4 max) [4]

Total 15 marks

SECTION B

Essays are marked both on their geological content and their quality of written communication [QWC]. To ensure comparability across all answers involving extended writing, mark band criteria are applied holistically to every essay answer before determining a final mark. The table containing the criteria is found after Q.4.

2. (a) swamps, plant material, hot and wet - maximum vegetation growth.
Warm - luxuriant growth
Fresh water - vegetation (indicated by freshwater bivalves), tropical
Quiet - material not swept away
Stagnant - rotting not complete
Sinking - continued deposition
Rapid burial, exclude oxygen/anaerobic, minimise rotting.
Burial raises temperature and pressure conditions.
TIME factor.
Coalification proceeds from partially decomposing vegetable matter such as peat,
through coal rank - lignite, bituminous coals to the highest grade of anthracite.
During this process, the percentage of carbon increases, and volatiles and moisture are gradually eliminated.
(12+1 max)

(b) any reasonable damage minimisation technique:

open cast - large area lain to waste and habitat damage (eyesore - banks and screens,
move endangered species, refurbish after), water pollution (monitor, dams),
removal and replacement of topsoil, during extraction - range of measures to
reduce dust (washing), noise (baffles), blast noise (restrict times), pollution of
access roads (improve roads), back filling and eventual replacement of
topsoil, landscaping/planting

deep mining - rocks from deep underground brought to surface, may not be stable,
subsidence (monitor and new buildings built with this in mind), pillars left
under important buildings, at pithead, disposal of spoil in as friendly a way as
possible (landscaped, planted), measures to reduce dust, acid mine drainage,
groundwater contamination e.g. By pyrite etc. spoil heaps cover land
surface, and water pollution risk (plus safety- Aberfan?), wheel washes for
vehicles to remove dust
water sprays to damp dust down, tree screens, minimal buildings
Credit examples
(12+1 max)

Total 25 marks
3. **Residual**
weathering removes soluble materials, leaves insoluble behind → residual concentration by removal of surrounding non-economic material
strong chemical weathering in hot and seasonally wet climates
deep rotting profiles of soil → laterites
Bauxite - concentration of Al
Feldspars (Al₂O₃) plus slightly acidic rainwater → rot → kaolinite
→ contains Al so is concentrated
Secondary enrichment
Heavy deposits - gold, tin

**Precipitated**
brine, evaporation>rainfall, high temperatures, evaporation process, halite.
Barred basins/refilling basins to give thicknesses seen in UK, gypsum, anhydrite crystallise then deposit, then halite, finally potassium and magnesium salts.
Evaporites (dolomite, gypsum/anhydrite, halite, bittern salts) - cycles of evaporation in basins (e.g. refill, basin and bar), and Sabkha deposits.

Banded Iron formations - PreCambrian before O₂ freely available in atmosphere,
shallow water but low energy (associated mud cracks and ripples), fine grains of silica and iron oxides precipitated in large basins.

Thin layers of metal sulphides deposited on sea floor when hot solutions rose through cracks in crust, hot fluids could dissolve metal sulphides, precipitated when meets cold sea water, sphalerite, galena, pyrite, silver

Also credit vein precipitates, ironstones/nodules. Credit examples

Looking for more than evaporation for good answer..

For highest marks (20 – 25 range) candidates must have attempted a comparison not just treated considered both separately.
Similarities – sedimentary processes in both
Differences – weathering v precipitation (sed and hydrothermal)

**Total 25 marks**

4. The appropriate method depends upon the geometry and physical properties of the resource. Evaluation involves advantages and disadvantages of technique. Credit for case studies.

(i) **geological mapping**
Field work based – direct observation using trained geologists.
Advantages:
- Very accurate in pinpointing resources at the surface prior to exploitation
- Can be very detailed – good to assess the problems of exploitation and viability of resource
- Samples can be collected for accurate analysis
Disadvantages:
- Labour intensive an time consuming
- Structural trends obscured on small scale
- Accuracy depends upon sample points and interpretation
- Possible problems of access in remote areas and lack of outcrops
(ii) **geochemical prospecting**

Sampling stream, sediment, soil or vegetation to find particular trace element concentrations which might indicate the presence of an economic resource. Concentrations vary with distance from the ore body. Copper and lead. Laboratory analysis.

**Advantages:**
- Sampling allows large catchment area to be investigated quickly
- All elements have a characteristic signatures which may show up in vegetation response and are easily recognised in soil and water samples
- Very dependable and cost effective

**Disadvantages:**
- Problem of contamination (earlier mining, processing, wind blown, flooding)
- Background rocks, variations in water ph, and ore concentrations can give misleading results.
- Access may be difficult over wider areas.

(iii) **satellite remote sensing**

Radiation is absorbed and reflected in different ways by different materials (rocks, soils and vegetation)

Materials emit different types of radiation depending upon temperature and molecular structure

Reflect radiation of several wavelengths (some in visible spectrum), analysed and displayed as a visual image

Suitable for major metalliferous deposits (e.g. copper, iron)

**Advantages:**
- Provides a large scale image relatively cheaply without need of fieldwork
- Inaccessible areas studied easily
- Large scale structures show up which might be missed in the field.
- Satellites are generally in place – only need to buy image required

**Disadvantages:**
- Used for only basic reconnaissance.

*Colours can be misleading*

Total 25 marks
### MARK BAND CRITERIA FOR GL5 ESSAYS.

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**MARK SPECIFICATION GRID**

**GCE GEOLOGY**

**UNIT TEST**

Year of Examination ____ Specimen ________  Page ___1___ of ___1___

Session: summer/winter

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**Synoptic**

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Specifically in this test: structural principles; sedimentary properties and processes; environmental sustainability; mineral properties are involved in the assessment of the Geology of Natural Resources.

**Quality of written communication**

The mark band criteria found in the Section B mark scheme are applied to every essay question before determining a final mark. To ensure comparability across all answers involving extended writing these mark band criteria are applied holistically to each essay. Essays are marked both on their geological content and their quality of written communication [QWC]. The mark band criteria include three strands of QWC which require that candidates:

(i) ensure that text is legible and that spelling, punctuation and grammar are accurate so that meaning is clear;

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(iii) organise information clearly and coherently, using specialist vocabulary when appropriate.
GL5

THEMATIC UNIT 3

GEOLOGICAL EVOLUTION OF BRITAIN

MARK SCHEME

Range of acceptable answers

The answers given in the marking schemes in this Specimen Assessment Materials document are those that would be acceptable to the Chief Examiner. However, alternative answers that are correct and relevant to the question are to be given appropriate credit by markers.

1. (a) Unconformity (1)
   Evidence (1) – one of:
   difference in dip; discordance; cuts across; folded below / horiz above
   difference in age (UIO overlying Carboniferous at Vallis Vale)
   basal conglomerate
   overstep of UIO onto the Carboniferous Limestone [2]

(b) (i) Cheltenham 90 to 110 m         Vallis Vale 4 to 8 m [1]
   (ii) Two of:
   absence of Lower and Middle Inferior Oolite
   Vallis Vale above sea level for some of the time
   Inferior Oolite deposited at Vallis Vale then eroded
   basin of deposition at Cheltenham [2]

(c) folding of Middle Inferior Oolite (1)
   Upper Inferior Oolite horizontal(1) / unfolded (1)
   (horizontal) unconformity (1) erosion (1) separates (above) [3]

(d) (i) marine – brachiopods
   ENERGY / current (tidal) action- ooliths/abraded fossils/
   conglomerate
   shallow – ooliths/precipitation of calcite/conglomerate
   warm sea – precipitation of calcite
   time of little deposition – borings/ abundant bivalves
   characteristic with evidence for 2 marks (2 x 2) [4]

(ii) HOLISTIC - relating data provided with possible environment
   water temp 25ºC tropical – colonial corals/ abundant fossils
   = less clastic material; oolites = high evapoartion? CaC03 pptn
   colonial CORALS in situ – reef habitat/ reef framework
   oxygen and food available
   ENERGY / conglomerate / oolites / broken brachiopods
   - consequence of depth/ relationship to reef .
   3 differences explained for 3 marks [3]

Total 15 marks
SECTION B

Essays are marked both on their geological content and their quality of written communication [QWC]. To ensure comparability across all answers involving extended writing, mark band criteria are applied holistically to every essay answer before determining a final mark. The table containing the criteria is found after Q.4.

2. Carboniferous limestones, corals
   implies tropical shallow seas
   large brachiopods
   coal seatearth (fossil soil)
   implies tropical forest/swamp
deltaic
abundant plant fossils
large fossil insects
amphibians

Permo-Triassic breccias, dune cross bedding
implies desert latitude
haematite, textures, conglomerates,
hypersaline/flashflood
evaporites, mudcracks,
lack of fossils

Jurassic/Cretaceous carbonates, deltaic, coal
implies high temperature/
corals, marine reptiles
tropical but mid latitude
ammonites
at time of high global
temperature

Must have evidence from rocks, sedimentary structures and fossils plus a statement of implied climatic zone. Relies on Uniformitarianism for comparison with modern sediments and fossils which may or may not be valid as species may adapt although processes should be comparable. Indicates climate but not latitude as climatic belts and global temperatures may have changed. May refer to palaeomagnetic evidence.

Total 25 marks
3. (a) Desert arid climate in Permo-Triassic.

**Mineralogy**
- Predominance of quartz sandstone.
- Lack of chemical weathering resulting in feldspathic sandstones.
- Evaporite minerals such as halite and gypsum indicate evaporation of salt lakes.
- Mineralogical maturity.

**Texture**
- Textural maturity. Well rounded, well sorted, medium grained sandstones. Frosted grains. Indicate wind blown material.
- Coarse grained, poorly sorted, angular clasts of breccias indicate flash floods. Faceted pebbles.

**Sedimentary structures**
- Large scale dune cross-bedding, mudcracks.

**Fossils**
- General lack of fossils. Vertebrates and foot prints. Unsuitable conditions for preservation.

(b) Application of Uniformitarianism. Distinctive combination of textures, evaporites and dune cross-bedding reliable indicators of climate. More reliable than sandstones with other textures. Dunes can occur in other environments such as supratidal and other climates. Evaporates can form in lagoonal/marine conditions. Lack of fossils not useful.

Total 25 marks

4. **Magnetic inclination**
- Orientation of magnetic minerals in rocks aligned parallel to magnetic field at time of cooling - Curie Point
- Angle of inclination which indicates direction of pole and latitude
- Diagram of changes in magnetic inclination with latitude as UK drifts through latitude - angle of inclination changes in rocks of different ages and shows changes of latitude with time can be preserved in sediments aligned during deposition

**Apparent polar wandering**
- Determination of position of magnetic pole at time of cooling (remnant magnetism) determined in rocks of different ages
- Plotting positions and ages on a map and joining up points to produce an apparent polar wandering curve for a continent
- Positions of pole relative to continent gives latitude of continent at a particular time and shows changes over time

**Evaluation**
- Useful technique backed up by study of sediments
- Assumes magnetic field has always been dipolar and close to geographic north cannot determine longitude
- Inaccuracies caused by problems with radiometric dating of rocks
- Assumes: rocks: not overturned or magnetically disturbed since formation

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Specifically in this test: stratigraphical principles; fossils; sedimentary rocks, structures, environments and mapping techniques; structural geology; climate change; plate tectonics; are involved in the assessment of the Geological Evolution of Britain.

## Quality of written communication

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THEMATIC UNIT 4

GEOLOGY OF THE LITHOSPHERE

MARK SCHEME

Range of acceptable answers

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1. (a) (i) Arrow at appropriate location. (1) [1]
   (ii) ~90kms (Accept 85 - 95) (1) [1]
   (iii) iron minerals in magma (1)
        orientation in direction of magnetic field (1)
        locked when magma falls (1)
        below curie temp (1)
        reversal in polarity from normal with time (Reserved 1)
        (1 R plus any 2) [3]

   (b) (i) Distance/Time in working (1)
       ~ 4.5 cm/yr (1) [2]
       (ii) Explanation of the radiometric dating of:
            Mantle plume (hotspot) volcanic island chains (2)
            Basalt rock samples and distance from ridge (2)
            Ocean floor sediments and distance from ridge (2)
            (max 2 +2) [4]

   (c) PACIFIC (1) (R)
       Ocean ridge is not central in Pacific/MAR is central in Atlantic (1)
       Ocean basin biggest (wider) in Pacific (older)(1)
       Pacific surrounded by trenches (few in Atlantic) (1)
       Subduction well underway at edges/ minor in Atlantic (1)
       Faster rate of seafloor spreading in Pacific (1)
       (1 R +3 max) [4]

Total 15 marks
SECTION B

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2. Features from:

- Shield (Craton) - old, regionally metamorphosed, stable, thick, lower density. Form core of continents usually surrounded by younger provinces. e.g. Canadian etc.

- Orogenic belts - Fold mts/collision zones, Cordilleran mountain belts
  - Crustal shortening (thrusting/folding/nappes) seismics/volcanics/
  - Metamorphism e.g. Andes/Alpes. Foreland basins.
  - Crustal extension e.g. North Sea, East African Rift.
  - Extensional basins
  
- Credit Ophiolite/accretionary prisms.
- Continental Shelves/Slopes - Size depends upon boundary type-leading/trailing edges.

Ages distributions within a continent - e.g. North America.

- Origins - Low density crust not subducted at
  - Continent-continent
  - Continent-island arc collisions.
  - Crustal melting and granite magmatism
  - Crustal thickening
  - Delamination, isotatic uplift and gravitational collapse.
  - Ophiolite formation
  - Lithospheric extension - extensional basins
  - Lithospheric loading - foreland basins.

Holistic approach Depth v breadth

3. Holistic approach (12+1 marks description) (12+1 marks explanation)

Define earthquake body waves.

Use of/explanation of formulae for P and S wave velocities.

Incompressibility v density changes - P-wave

Rigidity v density - S-wave

Depth profile of P and S waves to show velocity variation.

Depth of the Low velocity zone with distance from spreading centre.

Thickening of the lithosphere with age and distance from ridge.

Diagrams credited

Definition of the difference between Lithosphere and Asthenosphere in terms of mechanical properties.

Lithosphere = plate. Cold (<1300° C isotherm) - Brittle thus fractures.

Asthenosphere = partially molten (5 %) - Ductile thus flows

Total 25 marks
4.  (a) Ridge - (High) Thermally varied. High range of heat flow (high to low) temperatures. Above world average. Heat loss by conduction/radiation. Results from rising magma, "black smoker". Examples credited

Abyssal plain (Lower) Thermally stable: low range of heat flow. Below average heat flow. Heat loss greater further from the ridge. May increase above average at a "hot spot". E.g. Hawaii etc.


Continental margin - (High) Rising andesitic magma at destructive margin. Example

Diagrams credited throughout. (12 +1 max description)

(b) Ridge - Associated with rising convection current in the mantle at spreading centre. Constructive margin.

Abyssal plain - Owing to conduction and radiation of older lithosphere as plate moves further from spreading centre. Hot spot - relates to "mantle plume". Associated with "mantle dynamics" rather than "plate tectonics".

Trench - as ocean plate descends before subduction. Descending currents.

Continental margin - Melting of subducting plate (and/or overlying mantle/continental root). Examples. Effect of water on melting temperatures.

Diagrams credited throughout. Holistic approach if they join (a) and (b). (12 +1 max explanation)

Total 25 marks
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<td>Wholly irrelevant or nothing written.</td>
<td></td>
</tr>
</tbody>
</table>

N.B. Where students fail to write fully and fluently in continuous prose, a maximum mark of 19 out of 25 will be awarded.
### MARK SPECIFICATION GRID
#### GCE GEOLOGY
**UNIT TEST**

**Year of Examination ____Specimen______**

**Session: summer/winter**

<table>
<thead>
<tr>
<th>AS Unit -GL5 (Unit 4)</th>
<th>Assessment Objective</th>
<th>Paper Total Mark</th>
<th>Other requirements</th>
</tr>
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<tbody>
<tr>
<td><strong>AO1</strong></td>
<td><strong>AO2</strong></td>
<td><strong>AO3</strong></td>
<td><strong>Synoptic</strong></td>
</tr>
<tr>
<td>Target Totals</td>
<td>14</td>
<td>24</td>
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#### Question Number

<table>
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<tr>
<th>Question Number</th>
<th>Specification Reference</th>
<th>AO1</th>
<th>AO2</th>
<th>AO3</th>
<th>Synoptic</th>
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<td>KI 2c</td>
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<td>1a (ii)</td>
<td>KI 2c</td>
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<tr>
<td>1b (i)</td>
<td>KI 2c</td>
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<td>1b (ii)</td>
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<td>1c</td>
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<td>KI 2c/d</td>
<td>10</td>
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</tbody>
</table>

#### Raw Totals:

| Raw Totals: | 17 | 19 | 4 | 40 |

### Synoptic

This test uses techniques, concepts and theories relevant to geology to assess the ability to apply knowledge understanding and skills acquired in other parts of the course to a theme that shows the interconnections between different facets of geology. It necessitates that students identify the appropriate material required for an answer. Other tests may incorporate different geological techniques, concepts and theories.

Specifically in this test: plate tectonic processes and features; structure of the Earth; structural geology; earthquakes; are involved in the assessment of the Geological Evolution of Britain.

### Quality of written communication

The mark band criteria found in the Section B mark scheme are applied to every essay question before determining a final mark. To ensure comparability across all answers involving extended writing these mark band criteria are applied holistically to each essay. Essays are marked both on their geological content and their quality of written communication [QWC]. The mark band criteria include three strands of QWC which require that candidates:

(i) ensure that text is legible and that spelling, punctuation and grammar are accurate so that meaning is clear;

(ii) select and use a form and style of writing appropriate to purpose and to complex subject matter;

(iii) organise information clearly and coherently, using specialist vocabulary when appropriate.

GCE Geology SPAMs (2009-2010)/JD 13 August 2007