



---

# **GCE A LEVEL MARKING SCHEME**

---

**SUMMER 2025**

**A LEVEL  
GEOLOGY – COMPONENT 2  
A480U20-1**

---

## About this marking scheme

The purpose of this marking scheme is to provide teachers, learners, and other interested parties, with an understanding of the assessment criteria used to assess this specific assessment.

This marking scheme reflects the criteria by which this assessment was marked in a live series and was finalised following detailed discussion at an examiners' conference. A team of qualified examiners were trained specifically in the application of this marking scheme. The aim of the conference was to ensure that the marking scheme was interpreted and applied in the same way by all examiners. It may not be possible, or appropriate, to capture every variation that a candidate may present in their responses within this marking scheme. However, during the training conference, examiners were guided in using their professional judgement to credit alternative valid responses as instructed by the document, and through reviewing exemplar responses.

Without the benefit of participation in the examiners' conference, teachers, learners and other users, may have different views on certain matters of detail or interpretation. Therefore, it is strongly recommended that this marking scheme is used alongside other guidance, such as published exemplar materials or Guidance for Teaching. This marking scheme is final and will not be changed, unless in the event that a clear error is identified, as it reflects the criteria used to assess candidate responses during the live series.

---

**GCE A LEVEL GEOLOGY**  
**COMPONENT 2 - GEOLOGICAL PRINCIPLES AND PROCESSES**  
**SUMMER 2025 MARK SCHEME**

**Instructions for examiners of A Level Geology when applying the mark scheme**

**1 Positive marking**

It should be remembered that candidates are writing under examination conditions and credit should be given for what the candidate writes, rather than adopting the approach of penalising him / her for any omissions. It should be possible for a very good response to achieve full marks and a very poor one to achieve zero marks. Worthwhile answers that meet the requirements of the question, but do not appear on the mark scheme are to be given credit.

**2 Tick marking**

Low tariff questions should be marked using a points-based system. Each credit worthy response should be ticked in red pen. The number of ticks must equal the mark awarded for the sub-question. The mark scheme should be applied precisely using the marking details box as a guide to the responses that are acceptable. Do not use crosses to indicate answers that are incorrect.

**3 Annotated diagrams**

Where a candidate has answered a question wholly or partly by use of an annotated diagram, credit must be awarded to the annotations which form credit-worthy responses as outlined in the marking details box. Candidates must be credited only once for valid responses which appear both as annotations to diagrams and within a section of prose in the answer to the same question.

**4. Banded mark schemes**

Banded mark schemes are divided so that each band has a relevant descriptor. The descriptor for the band provides a description of the performance level for that band. Each band contains marks. Examiners should first read and annotate a learner's answer to pick out the evidence that is being assessed in that question. **Do not use ticks** on the candidate's response. Once the annotation is complete, the mark scheme can be applied. This is done as a two-stage process.

## **Stage 1 – Deciding on the band**

When deciding on a band, the answer should be viewed holistically. Beginning at the lowest band, examiners should look at the learner's answer and check whether it matches the descriptor for that band. Examiners should look at the descriptor for that band and see if it matches the qualities shown in the learner's answer. If the descriptor at the lowest band is satisfied, examiners should move up to the next band and repeat this process for each band until the descriptor matches the answer.

If an answer covers different aspects of different bands within the mark scheme, a 'best fit' approach should be adopted to decide on the band and then the learner's response should be used to decide on the mark within the band. For instance if a response is mainly in band 2 but with a limited amount of band 3 content, the answer would be placed in band 2, but the mark awarded would be close to the top of band 2 as a result of the band 3 content.

Examiners should not seek to mark candidates down as a result of small omissions in minor areas of an answer.

## **Stage 2 – Deciding on the mark**

Once the band has been decided, examiners can then assign a mark. During standardising (marking conference), detailed advice from the Principal Examiner on the qualities of each mark band will be given. Examiners will then receive examples of answers in each mark band that have been awarded a mark by the Principal Examiner. Examiners should mark the examples and compare their marks with those of the Principal Examiner.

When marking, examiners can use these examples to decide whether a learner's response is of a superior, inferior or comparable standard to the example. Examiners are reminded of the need to revisit the answer as they apply the mark scheme in order to confirm that the band and the mark allocated is appropriate to the response provided.

Indicative content is also provided for banded mark schemes. Indicative content is not exhaustive, and any other valid points must be credited. In order to reach the highest bands of the mark scheme a learner need not cover all of the points mentioned in the indicative content but must meet the requirements of the highest mark band. Where a response is not creditworthy, that is contains nothing of any significance to the mark scheme, or where no response has been provided, no marks should be awarded.

| Question |     |       | Marking details                                                                                                                                                                                              | Marks Available |     |     |       |       |      |
|----------|-----|-------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|-----|-----|-------|-------|------|
|          |     |       |                                                                                                                                                                                                              | AO1             | AO2 | AO3 | Total | Maths | Prac |
| 1        | (a) | (i)   | Oxygen (1)<br>Magnesium (1)<br><i>Must be in this order</i><br>(accept O and Mg)                                                                                                                             | 2               |     |     | 2     |       |      |
|          |     | (ii)  | Al = 0.90<br>K = 0.10 (1)<br><i>Both required to award mark</i>                                                                                                                                              |                 | 1   |     | 1     | 1     | 1    |
|          |     | (iii) | Iron meteorite (1)                                                                                                                                                                                           | 1               |     |     | 1     |       |      |
|          |     | (iv)  | Siderophile (1)                                                                                                                                                                                              | 1               |     |     | 1     |       |      |
|          | (b) | (i)   | 500km (accept 400km to 600km) (1)<br>Mantle (accept asthenosphere) (1)                                                                                                                                       | 2               |     |     | 2     | 1     | 1    |
|          |     | (ii)  | Beginning of the inner core (1)<br>Represents a change in state from liquid to solid (1)                                                                                                                     |                 | 2   |     | 2     |       |      |
|          |     | (iii) | 11.5 g cm <sup>-3</sup> (accept 11.4-11.6) (1)                                                                                                                                                               | 1               |     |     | 1     | 1     | 1    |
|          |     | (iv)  | Substitution: $11.5 = 1.85 \times 10^{27} / V$ (1)<br>Rearranging: $1.85 \times 10^{27} / 11.5$ (1)<br>Answer in standard form: $1.61 \times 10^{26}$ (accept $1.6 \times 10^{26}$ ) (1)<br><br>(credit ecf) |                 | 3   |     | 3     | 3     | 3    |
|          |     |       | Question 1 total                                                                                                                                                                                             | 7               | 6   | 0   | 13    | 6     | 6    |

| Question |     |       | Marking details                                                                                                                                                                                                                                                                                                          | Marks Available |     |     |       |       |      |
|----------|-----|-------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|-----|-----|-------|-------|------|
|          |     |       |                                                                                                                                                                                                                                                                                                                          | AO1             | AO2 | AO3 | Total | Maths | Prac |
| 2        | (a) | (i)   | Throw = 5m (accept 4.8 to 5.2m) (1)                                                                                                                                                                                                                                                                                      |                 | 1   |     | 1     | 1     | 1    |
|          |     | (ii)  | Normal (1)<br><br><b>Any one x (1) from:</b> <ul style="list-style-type: none"> <li>hangingwall is downthrown</li> <li>fault dips towards the downthrown side</li> <li>crustal extension has occurred</li> </ul>                                                                                                         |                 | 2   |     | 2     |       |      |
|          |     | (iii) | <b>Any two x (1) from:</b> <ul style="list-style-type: none"> <li>yes - normal faults are extensional, not compressional</li> <li>yes - fault dips to west / strikes north-south</li> <li>only E-W section shown, possible apparent dip or strike / actual dip directions of fault planes unclear</li> </ul>             |                 |     | 2   | 2     |       | 2    |
|          |     | (iv)  | <b>Any two x (1) from:</b> <ul style="list-style-type: none"> <li>fault reactivation</li> <li>subsequent / recent compression (E-W)</li> <li>to a lesser extent</li> <li>E-W <math>\sigma_{min}</math> then <math>\sigma_{max}</math></li> </ul>                                                                         |                 |     | 2   | 2     |       |      |
|          | (b) |       | <b>Indicative content</b><br><br>G = desert sandstone, H = fault breccia (n)<br><br>G texture / composition / structure: <ul style="list-style-type: none"> <li>high quartz content / mineralogically mature (c)</li> <li>red haematite (c/f)</li> <li>texturally mature (t)</li> <li>well rounded grains (t)</li> </ul> |                 |     | 6   | 6     |       | 6    |

| Question |  |  | Marking details                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Marks Available |     |     |       |       |      |
|----------|--|--|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|-----|-----|-------|-------|------|
|          |  |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | AO1             | AO2 | AO3 | Total | Maths | Prac |
|          |  |  | <ul style="list-style-type: none"> <li>• well sorted grains (t)</li> <li>• medium grain size (t)</li> <li>• cross bedding (s)</li> </ul> <p>G mode of formation:</p> <ul style="list-style-type: none"> <li>• wind-blown / aeolian deposition (f)</li> <li>• attrition / abrasion of grains (f)</li> <li>• long transport history (f)</li> <li>• terrestrial (f)</li> <li>• oxidation / cemented (f)</li> </ul> <p>H texture / composition / structure:</p> <ul style="list-style-type: none"> <li>• sandstone rock fragments (c)</li> <li>• mineralogy similar to parent rock (c)</li> <li>• very fine matrix (t)</li> <li>• texturally immature (t)</li> <li>• angular grains (t)</li> <li>• poorly sorted grains (t)</li> <li>• possible foliation (s)</li> </ul> <p>H mode of formation:</p> <ul style="list-style-type: none"> <li>• metamorphism (f)</li> <li>• dynamic metamorphism (f)</li> <li>• relatively low temperatures / shallow depths (f)</li> <li>• shear deformation (f)</li> <li>• high localised (along fault plane) stress (f)</li> <li>• brittle deformation (f)</li> <li>• as competent rock (f)</li> </ul> |                 |     |     |       |       |      |

| Question |  |  | Marking details                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Marks Available |          |           |           |          |          |
|----------|--|--|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|----------|-----------|-----------|----------|----------|
|          |  |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | AO1             | AO2      | AO3       | Total     | Maths    | Prac     |
|          |  |  | <p><b>5-6 marks</b><br/>There is a clear response which describes and explains in detail most of the processes involved in the <b>formation</b> of the sandstone and fault breccia. This includes a thorough account of <b>both</b> aeolian deposition and dynamic metamorphism. A logical sequence of the processes is clearly developed drawing upon <b>at least two concepts</b> (textural, compositional, structural evidence from both Figure 2b and Figure 2c) and then subsequent inference.</p> <p><i>There is a sustained line of reasoning which is coherent, substantiated, and logically structured. The information included in the response is relevant.</i></p> <p><b>3-4 marks</b><br/>The response describes and explains how <b>at least one</b> of the concepts (texture, structure, and composition) of <b>at least one</b> of the rock types is indicative of terrestrial deposition and / or dynamic metamorphism having occurred respectively. A brief description of the processes is given but one concept interpretation may be missing. A logical sequence of the processes is developed in places but not throughout.</p> <p><i>There is a line of reasoning which is partially coherent, supported by some evidence and with some structure. Mainly relevant information is included but there may be some irrelevant information or minor errors.</i></p> <p><b>1-2 marks</b><br/>The response describes/ identifies <b>at least one</b> of the rock types and / or shows an awareness that terrestrial deposition or dynamic metamorphism has occurred. There is a lack of detail in the response and comment is rather superficial. There may be a significant lack of relevance in places.</p> <p><i>There is a basic line of reasoning which is not coherent, supported by limited evidence and with very little structure. There may be significant errors or the inclusion of much irrelevant information.</i></p> <p><b>0 marks</b><br/>No attempt made or no response worthy of credit</p> |                 |          |           |           |          |          |
|          |  |  | <b>Question 2 total</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | <b>0</b>        | <b>3</b> | <b>10</b> | <b>13</b> | <b>1</b> | <b>9</b> |

| Question |     |       | Marking details                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Marks Available |     |     |       |       |      |
|----------|-----|-------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|-----|-----|-------|-------|------|
|          |     |       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | AO1             | AO2 | AO3 | Total | Maths | Prac |
| 3        | (a) | (i)   | Distance measured 1434km (accept range 1400 to 1470) (1)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                 | 1   |     | 1     | 1     | 1    |
|          |     | (ii)  | Use of 14.5Ma (accept 14-15) (1)<br><br>1434km / ~14.5Ma<br>Distance / time = 9.90 cm yr <sup>-1</sup> (accept range 9.33 to 10.5 cm yr <sup>-1</sup> ) (1)<br><br>(Carry forward error in part (i))                                                                                                                                                                                                                                                                                                                                                                        |                 | 2   |     | 2     | 2     | 2    |
|          |     | (iii) | <b>Any three x (1) from:</b> <ul style="list-style-type: none"> <li>overall trend that younger volcanoes tend to have a higher rate of eruption</li> <li>opposite trend observed 14.5Ma to 7Ma ago, (and to a lesser extent 25Ma to 23Ma ago), when rate of eruption decreased</li> <li>data fluctuates significantly</li> <li>second highest rate of eruption (compared to today) during eruption of Pūhāhonu volcano 14.5Ma ago</li> <li>the Pūhāhonu volcano had a higher rate of eruption than the Kaua'i volcano, despite being older</li> </ul> Credit use of figures | 3               |     |     | 3     | 3     | 3    |
|          |     | (iv)  | Named hazard (1) <ul style="list-style-type: none"> <li>lava flows</li> <li>sulphur dioxide or other gas emissions</li> <li>ash / tephra</li> </ul> (Accept other relevant hazards)<br><br>Description (1)                                                                                                                                                                                                                                                                                                                                                                  | 2               |     |     | 2     |       |      |

| Question                  |                          |                               | Marking details                                                                                                                                                                                                                                                                                                                                                                                                  |  |                          |                               | Marks Available            |                         |      |            |       |                           |      |    |            |                       |                  |    |  |  |   |  |   |   |   |
|---------------------------|--------------------------|-------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--------------------------|-------------------------------|----------------------------|-------------------------|------|------------|-------|---------------------------|------|----|------------|-----------------------|------------------|----|--|--|---|--|---|---|---|
|                           |                          |                               |                                                                                                                                                                                                                                                                                                                                                                                                                  |  |                          |                               | AO1                        | AO2                     | AO3  | Total      | Maths | Prac                      |      |    |            |                       |                  |    |  |  |   |  |   |   |   |
|                           | (b)                      | (i)                           | <b>Any three x (1) from:</b> <ul style="list-style-type: none"><li>• age distribution: increases to NW / decreases to SE</li><li>• volcanoes extinct further from the volcanic centre</li><li>• basaltic magma associated with plume</li><li>• Pacific plate is moving in the same orientation as chain</li><li>• positive correlation (age distribution)</li><li>• Hawaii intraplate location = plume</li></ul> |  |                          |                               |                            | 3                       |      | 3          |       |                           |      |    |            |                       |                  |    |  |  |   |  |   |   |   |
|                           |                          | (ii)                          | Decompression melting (1)<br>Partial melting of mantle / peridotite (1)                                                                                                                                                                                                                                                                                                                                          |  |                          |                               |                            | 2                       |      | 2          |       |                           |      |    |            |                       |                  |    |  |  |   |  |   |   |   |
|                           | (c)                      | (i)                           | 1890°C (1)<br>(Accept 1885°C to 1895°C)                                                                                                                                                                                                                                                                                                                                                                          |  |                          |                               | 1                          |                         |      | 1          | 1     | 1                         |      |    |            |                       |                  |    |  |  |   |  |   |   |   |
|                           |                          | (ii)                          | <table><tr><td></td><td>Temperature of melt (°C)</td><td>Composition of crystals (%Fe)</td><td>Composition of melt ( %Fe)</td></tr><tr><td>Initial crystallisation</td><td>1780</td><td>08 (07-09)</td><td>25</td></tr><tr><td>Crystallisation at 1700°C</td><td>1700</td><td>16</td><td>41 (40-42)</td></tr><tr><td>Final crystallisation</td><td>1610 (1608-1612)</td><td>25</td><td></td></tr></table>        |  | Temperature of melt (°C) | Composition of crystals (%Fe) | Composition of melt ( %Fe) | Initial crystallisation | 1780 | 08 (07-09) | 25    | Crystallisation at 1700°C | 1700 | 16 | 41 (40-42) | Final crystallisation | 1610 (1608-1612) | 25 |  |  | 3 |  | 3 | 3 | 3 |
|                           | Temperature of melt (°C) | Composition of crystals (%Fe) | Composition of melt ( %Fe)                                                                                                                                                                                                                                                                                                                                                                                       |  |                          |                               |                            |                         |      |            |       |                           |      |    |            |                       |                  |    |  |  |   |  |   |   |   |
| Initial crystallisation   | 1780                     | 08 (07-09)                    | 25                                                                                                                                                                                                                                                                                                                                                                                                               |  |                          |                               |                            |                         |      |            |       |                           |      |    |            |                       |                  |    |  |  |   |  |   |   |   |
| Crystallisation at 1700°C | 1700                     | 16                            | 41 (40-42)                                                                                                                                                                                                                                                                                                                                                                                                       |  |                          |                               |                            |                         |      |            |       |                           |      |    |            |                       |                  |    |  |  |   |  |   |   |   |
| Final crystallisation     | 1610 (1608-1612)         | 25                            |                                                                                                                                                                                                                                                                                                                                                                                                                  |  |                          |                               |                            |                         |      |            |       |                           |      |    |            |                       |                  |    |  |  |   |  |   |   |   |
|                           |                          | (iii)                         | The basalt’s original melt has a low Fe content / high Mg content (compared to typical basalt) (forming high melting temperature forsterite olivine crystals) (1)                                                                                                                                                                                                                                                |  |                          |                               |                            | 1                       |      | 1          |       |                           |      |    |            |                       |                  |    |  |  |   |  |   |   |   |
|                           |                          |                               | Question 3 total                                                                                                                                                                                                                                                                                                                                                                                                 |  |                          |                               | 6                          | 12                      | 0    | 18         | 10    | 10                        |      |    |            |                       |                  |    |  |  |   |  |   |   |   |

| Question |     |       | Marking details                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Marks Available |     |     |       |       |      |
|----------|-----|-------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|-----|-----|-------|-------|------|
|          |     |       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | AO1             | AO2 | AO3 | Total | Maths | Prac |
| 4        | (a) | (i)   | <p>Correct thickness of beds, and correct way up (1)</p> <p><b>Any two x (1) from:</b></p> <ul style="list-style-type: none"> <li>correct grain size of the top and bottom beds</li> <li>correct grain size of the thinner bed</li> <li>correct symbols</li> </ul>                                                                                                                                                                                                                   | 3               |     |     | 3     | 1     | 3    |
|          |     | (ii)  | <p>Line, from base to top, must show increasing then decreasing sea level with the change somewhere between 17m and 42m height (1)</p> <p>Line must stay between 0m and 50m height (1)</p>                                                                                                                                                                                                                                                                                           |                 | 2   |     | 2     | 2     | 2    |
|          | (b) | (i)   | <p>K (1)</p> <p><b>Any two x (1) from:</b></p> <ul style="list-style-type: none"> <li>the finest sediment in this borehole is medium grained sandstone / K does not contain fine sandstone</li> <li>the coarsest sediment in this borehole is <b>very coarse</b> sandstone / L and M do not contain very coarse sandstone</li> <li>broken fossils more likely in a higher energy environment</li> <li>symmetrical ripple marks more likely in a higher energy environment</li> </ul> |                 |     | 3   | 3     |       | 3    |
|          |     | (ii)  | <p>Marine transgression (1)</p> <p>The facies / all facies are moving landward (1)</p>                                                                                                                                                                                                                                                                                                                                                                                               |                 | 2   |     | 2     |       |      |
|          |     | (iii) | A vertical sequence of strata (in one place) may represent facies that once existed beside one another (at one time) (1)                                                                                                                                                                                                                                                                                                                                                             | 1               |     |     | 1     |       |      |

| Question |  |      | Marking details                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Marks Available |     |     |       |       |      |
|----------|--|------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|-----|-----|-------|-------|------|
|          |  |      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | AO1             | AO2 | AO3 | Total | Maths | Prac |
|          |  | (iv) | <p><b>Maximum of 3 marks in total</b></p> <p>Walther's Law - <b>any two x (1) from:</b></p> <ul style="list-style-type: none"> <li>the sedimentary rocks shown represent environments that exist side by side today</li> <li>it only applies to facies that are superimposed without a break</li> <li>there may be unconformities in the sequence in Figure 4b so it can't be applied to interpret the geology</li> <li>it explains the diachronism observed</li> </ul> <p>Decreasing energy – <b>any two x (1) from:</b></p> <ul style="list-style-type: none"> <li>overall decreasing energy would indicate a transgression</li> <li>there are 3 occasions which could be interpreted as decreasing energy</li> <li>but there are 3/4 occasions which could be interpreted as increasing energy</li> <li>overall, the coarser sediments have moved inland</li> <li>indicating that overall energy levels are decreasing / transgression</li> <li>however, the most recent deposition suggests regression</li> </ul> <p>to a maximum of 3 marks in total</p> |                 |     | 3   | 3     |       |      |

| Question |     |      | Marking details                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Marks Available |          |          |           |          |           |
|----------|-----|------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|----------|----------|-----------|----------|-----------|
|          |     |      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | AO1             | AO2      | AO3      | Total     | Maths    | Prac      |
|          | (c) | (i)  | Cross bedding (1)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 1               |          |          | 1         |          |           |
|          |     | (ii) | <p><b>Named</b> sedimentary structure: Accept flute casts, symmetrical ripple marks, asymmetrical ripple marks, imbrication (1)</p> <p><b>Description: max 2 marks</b></p> <ul style="list-style-type: none"> <li>• scale or reference to size</li> <li>• standard of drawing</li> <li>• standard of written description</li> </ul> <p><b>Movement direction</b></p> <ul style="list-style-type: none"> <li>• current direction indicated e.g., correct arrow on diagram (1)</li> <li>• written / annotated evidence of the feature of the sedimentary structure which demonstrates movement direction (1)</li> </ul> |                 | 5        |          | 5         |          | 2         |
|          |     |      | <b>Question 4 total</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | <b>5</b>        | <b>9</b> | <b>6</b> | <b>20</b> | <b>3</b> | <b>10</b> |

| Question |     |      | Marking details                                                                                                                                                                                                                                                                                                                          | Marks Available |     |     |       |       |      |
|----------|-----|------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|-----|-----|-------|-------|------|
|          |     |      |                                                                                                                                                                                                                                                                                                                                          | AO1             | AO2 | AO3 | Total | Maths | Prac |
| 5        | (a) | (i)  | <b>Any one x (1) from:</b> <ul style="list-style-type: none"> <li>• outgassing from the ocean</li> <li>• decomposing vegetation and other biomass</li> <li>• volcanoes</li> <li>• naturally occurring wildfires</li> <li>• ruminant animals</li> <li>• respiration</li> <li>• credit other reasonable answers</li> </ul>                 | 1               |     |     | 1     |       |      |
|          |     | (ii) | <ul style="list-style-type: none"> <li>• Credit use of two correct values (1)</li> </ul> <b>Any two x (1) from:</b> <ul style="list-style-type: none"> <li>• slow rise / constant (from 1500 to 1530)</li> <li>• steep fall (from 1570 to 1610)</li> <li>• rise (from 1610 to 1780)</li> <li>• steep rise (from 1780 to 1940)</li> </ul> | 3               |     |     | 3     | 3     | 3    |

| Question |     |  | Marking details                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Marks Available |     |     |       |       |      |
|----------|-----|--|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|-----|-----|-------|-------|------|
|          |     |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | AO1             | AO2 | AO3 | Total | Maths | Prac |
|          | (b) |  | <p><b>Indicative content</b></p> <p>Possible markers:</p> <ul style="list-style-type: none"> <li>the decrease in carbon dioxide during the year 1610</li> <li>the peak in global radiation in the year 1964</li> <li>the disappearance of certain animals and / or plants from the record</li> <li>appearance and increased abundance of plastics etc.</li> <li>appearance and increased abundance of materials due to technological advances e.g. heavy metals</li> <li>landfill</li> <li>agriculture e.g. grass pollen</li> </ul> <p>Possible explanations:</p> <ul style="list-style-type: none"> <li>the colonisation of the Americas by Europeans wiped out up to 95% of the indigenous population and decreased agriculture resulting in re-forestation</li> <li>caused by nuclear testing</li> <li>the extinction of certain animals and / or plants</li> <li>anthropogenic waste disposal and lack of recycling leading to human-made material in the record</li> <li>invention of specific technology e.g., automobiles have had an irreversible impact on the climate of the planet</li> <li>industrialisation (e.g., of Europe and N. America) has had an irreversible impact on the climate of the planet</li> </ul> <p>Evaluation:</p> <ul style="list-style-type: none"> <li>recognition that not all proposals are an entirely global event or lead to global distribution</li> <li>recognition that it should be justified by novel biotic, sedimentary, <i>and</i> geochemical changes</li> <li>recognition that all methods are not necessarily reliable e.g., arguably there is a delay in trapping gas bubbles in ice cores</li> <li>the statement refers to increase, yet some of the markers are decreasing e.g. radioactive markers</li> </ul> |                 |     | 6   | 6     |       |      |

| Question |  |  | Marking details                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Marks Available |          |          |           |          |          |
|----------|--|--|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|----------|----------|-----------|----------|----------|
|          |  |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | AO1             | AO2      | AO3      | Total     | Maths    | Prac     |
|          |  |  | <p><b>5-6 marks</b><br/>There is a clear response which describes at least <b>two</b> potential anthropogenic markers and explains at least <b>two</b> of them. A clear evaluation is made i.e., candidates clearly recognise some of the problems in using these data to assign the boundary.</p> <p><i>There is a sustained line of reasoning which is coherent, substantiated and logically structured. The information included in the response is relevant.</i></p> <p><b>3-4 marks</b><br/>The response describes at least <b>two</b> potential anthropogenic markers and explains at least <b>one</b> of them. A partial evaluation may be or may not be made i.e., candidates recognise there may be problems in assigning the boundary to these dates.</p> <p><i>There is a line of reasoning which is partially coherent, supported by some evidence and with some structure. Mainly relevant information is included but there may be some irrelevant information or minor errors.</i></p> <p><b>1-2 marks</b><br/>The response describes at least <b>one</b> potential anthropogenic marker. However, there is a lack of detail in the response and comment is rather superficial. There may be a significant lack of relevance in places. No evaluation is made. <i>There is a basic line of reasoning which is not coherent, supported by limited evidence and with very little structure. There may be significant errors or the inclusion of much irrelevant information.</i></p> <p><b>0 marks</b><br/>No attempt made or no response worthy of credit.</p> |                 |          |          |           |          |          |
|          |  |  | <b>Question 5 total</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | <b>4</b>        | <b>0</b> | <b>6</b> | <b>10</b> | <b>3</b> | <b>3</b> |

| Question |     |       | Marking details                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Marks Available |     |     |       |       |      |
|----------|-----|-------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|-----|-----|-------|-------|------|
|          |     |       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | AO1             | AO2 | AO3 | Total | Maths | Prac |
| 6        | (a) | (i)   | Carboniferous (1)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 1               |     |     | 1     |       |      |
|          |     | (ii)  | Uniformitarianism (1)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 1               |     |     | 1     |       |      |
|          |     | (iii) | <b>Any one x (1) from:</b><br><br><b>Similarities:</b> <ul style="list-style-type: none"> <li>in both J and K, feature A are a similar length</li> <li>in both J and K feature B grows at an angle to the leaf stem</li> <li>in both J and K each feature A contains multiple B features</li> <li>in both J and K each feature B is offset from the opposite feature B</li> <li>in both J and K each feature B is tapered at the end</li> </ul> <b>Any one x (1) from:</b><br><br><b>Differences:</b> <ul style="list-style-type: none"> <li>J has smooth B features / K has serrated B features</li> <li>feature B is larger in J / feature B is smaller in K</li> <li>J has rounded ends; K has pointed ends</li> </ul> | 2               |     |     | 2     |       |      |
|          |     | (iv)  | <b>Any two x (1) from:</b> <ul style="list-style-type: none"> <li>fossil specimen J is incomplete</li> <li>fossil specimen may be distorted</li> <li>J and K are different species</li> <li>cannot count the exact number of B features on each feature A because may be incomplete</li> <li>cannot confirm that fossil J had multiple A features</li> </ul> Credit other reasonable answers                                                                                                                                                                                                                                                                                                                              |                 | 2   |     | 2     |       |      |
|          |     | (v)   | Carbonisation (1)<br><br><b>Any two x (1) from:</b> <ul style="list-style-type: none"> <li>the plant is compressed / the organic material is flattened</li> <li>in anoxic conditions</li> <li>volatiles such as oxygen and water</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                 | 3   |     | 3     |       |      |

| Question |     |      | Marking details                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Marks Available |           |           |           |           |           |
|----------|-----|------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|-----------|-----------|-----------|-----------|-----------|
|          |     |      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | AO1             | AO2       | AO3       | Total     | Maths     | Prac      |
|          |     |      | <ul style="list-style-type: none"> <li>are squeezed out and removed</li> <li>leaving a thin film</li> <li>of carbon behind</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                 |           |           |           |           |           |
|          | (b) | (i)  | 0.1 (1) to 30 cm <sup>2</sup> (1)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 2               |           |           | 2         | 2         | 2         |
|          |     | (ii) | Line at 4 cm <sup>2</sup> (tolerance of 1 mm either way)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 1               |           |           | 1         | 1         | 1         |
|          | (c) | (i)  | <b>Any two x (1) from:</b> <ul style="list-style-type: none"> <li>leaf surface area increases with decreasing latitude / reference to relationship</li> <li>non-linear</li> <li>credit use of figures</li> <li>peak surface area at slightly north of the equator</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                 | 2         |           | 2         | 2         | 2         |
|          |     | (ii) | <b>Any two x (1) from:</b> <ul style="list-style-type: none"> <li>lower latitude climates have a greater mean temperature <b>or</b> lower latitude climates have a higher rate of precipitation</li> <li>leaves in lower latitudes (warmer climates) may need a greater surface area (for transpiration) to keep cool</li> <li>leaves in lower latitudes (warmer climates) are permitted to have a greater surface area due to less risk of water loss</li> <li>leaves in higher latitudes (colder climates) may need to reduce surface area to prevent water loss</li> <li>leaves in higher latitudes (colder climates) may need to reduce surface area to prevent frost damage</li> <li>broad leaf to maximise photosynthesis and overcome shading by canopy in tropical rainforests</li> </ul> |                 | 2         |           | 2         |           |           |
|          |     |      | <b>Question 6 total</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | <b>7</b>        | <b>9</b>  | <b>0</b>  | <b>16</b> | <b>4</b>  | <b>4</b>  |
|          |     |      | <b>Paper Totals</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | <b>29</b>       | <b>39</b> | <b>22</b> | <b>90</b> | <b>27</b> | <b>42</b> |