

GCE

Geology

H414/03: Practical skills in geology

A Level

Mark Scheme for June 2024

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This mark scheme is published as an aid to teachers and students, to indicate the requirements of the examination. It shows the basis on which marks were awarded by examiners. It does not indicate the details of the discussions which took place at an examiners' meeting before marking commenced.

All examiners are instructed that alternative correct answers and unexpected approaches in candidates' scripts must be given marks that fairly reflect the relevant knowledge and skills demonstrated.

Mark schemes should be read in conjunction with the published question papers and the report on the examination.

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MARKING INSTRUCTIONS

PREPARATION FOR MARKING RM ASSESSOR

1. Make sure that you have accessed and completed the relevant training packages for on-screen marking: *RM Assessor Assessor Online Training*; *OCR Essential Guide to Marking*.
2. Make sure that you have read and understood the mark scheme and the question paper for this unit. These are posted on the RM Cambridge Assessment Support Portal <http://www.rm.com/support/ca>
3. Log-in to RM Assessor and mark the **required number** of practice responses (“scripts”) and the **number of required** standardisation responses.

YOU MUST MARK 10 PRACTICE AND 10 STANDARDISATION RESPONSES BEFORE YOU CAN BE APPROVED TO MARK LIVE SCRIPTS.

MARKING

1. Mark strictly to the mark scheme.
2. Marks awarded must relate directly to the marking criteria.
3. The schedule of dates is very important. It is essential that you meet the RM Assessor 50% and 100% (traditional 40% Batch 1 and 100% Batch 2) deadlines. If you experience problems, you must contact your Team Leader (Supervisor) without delay.
4. If you are in any doubt about applying the mark scheme, consult your Team Leader by telephone or the RM Assessor messaging system, or by email.
5. **Crossed Out Responses**
Where a candidate has crossed out a response and provided a clear alternative then the crossed out response is not marked. Where no alternative response has been provided, examiners may give candidates the benefit of the doubt and mark the crossed out response where legible.

Rubric Error Responses – Optional Questions

Where candidates have a choice of question across a whole paper or a whole section and have provided more answers than required, then all responses are marked and the highest mark allowable within the rubric is given. Enter a mark for each question answered into RM assessor, which will select the

highest mark from those awarded. *(The underlying assumption is that the candidate has penalised themselves by attempting more questions than necessary in the time allowed.)*

Multiple Choice Question Responses

When a multiple choice question has only a single, correct response and a candidate provides two responses (even if one of these responses is correct), then no mark should be awarded (as it is not possible to determine which was the first response selected by the candidate).

When a question requires candidates to select more than one option/multiple options, then local marking arrangements need to ensure consistency of approach.

Contradictory Responses

When a candidate provides contradictory responses, then no mark should be awarded, even if one of the answers is correct.

Short Answer Questions (requiring only a list by way of a response, usually worth only **one mark per response**)

Where candidates are required to provide a set number of short answer responses then only the set number of responses should be marked. The response space should be marked from left to right on each line and then line by line until the required number of responses have been considered. The remaining responses should not then be marked. Examiners will have to apply judgement as to whether a 'second response' on a line is a development of the 'first response', rather than a separate, discrete response. *(The underlying assumption is that the candidate is attempting to hedge their bets and therefore getting undue benefit rather than engaging with the question and giving the most relevant/correct responses.)*

Short Answer Questions (requiring a more developed response, worth **two or more marks**)

If the candidates are required to provide a description of, say, three items or factors and four items or factors are provided, then mark on a similar basis – that is downwards (as it is unlikely in this situation that a candidate will provide more than one response in each section of the response space.)

Longer Answer Questions (requiring a developed response)

Where candidates have provided two (or more) responses to a medium or high tariff question which only required a single (developed) response and not crossed out the first response, then only the first response should be marked. Examiners will need to apply professional judgement as to whether the second (or a subsequent) response is a 'new start' or simply a poorly expressed continuation of the first response.

6. Always check the pages (and additional objects if present) at the end of the response in case any answers have been continued there. If the candidate has continued an answer there, then add a tick to confirm that the work has been seen.
7. Award No Response (NR) if:
 - there is nothing written in the answer space

Award Zero '0' if:

- anything is written in the answer space and is not worthy of credit (this includes text and symbols).

Team Leaders must confirm the correct use of the NR button with their markers before live marking commences and should check this when reviewing scripts.

8. The RM Assessor **comments box** is used by your team leader to explain the marking of the practice responses. Please refer to these comments when checking your practice responses. **Do not use the comments box for any other reason.**
If you have any questions or comments for your team leader, use the phone, the RM Assessor messaging system, or e-mail.
9. Assistant Examiners will send a brief report on the performance of candidates to their Team Leader (Supervisor) via email by the end of the marking period. The report should contain notes on particular strengths displayed as well as common errors or weaknesses. Constructive criticism of the question paper/mark scheme is also appreciated.
10. For answers marked by levels of response:

Read through the whole answer from start to finish, using the Level descriptors to help you decide whether it is a strong or weak answer. The indicative scientific content in the Guidance column indicates the expected parameters for candidates' answers, but be prepared to recognise and credit unexpected approaches where they show relevance. Using a 'best-fit' approach based on the skills and science content evidenced within the answer, first decide which set of level descriptors, Level 1, Level 2 or Level 3, best describes the overall quality of the answer.

Once the level is located, award the higher or lower mark:

The higher mark should be awarded where the level descriptor has been evidenced and all aspects of the communication statement (in italics) have been met.

The lower mark should be awarded where the level descriptor has been evidenced but aspects of the communication statement (in italics) are missing.
















In summary:

The skills and science content determines the level.

The communication statement determines the mark within a level.

Level of response questions on this paper are **1(c)** and **2(b)(iii)**.

11. Annotations

Annotation	Meaning
	Correct response
	Incorrect response
	Omission mark
	Benefit of doubt given
	Contradiction
	Rounding error
	Error in number of significant figures
	Error carried forward
	Level 1
	Level 2
	Level 3
	Benefit of doubt not given
	Noted but no credit given
	Ignore
	Blank page

12. Subject Specific Marking Instructions

Abbreviations, annotations and conventions used in the detailed Mark Scheme (to include abbreviations and subject-specific conventions).

Annotation	Meaning
/	alternative and acceptable answers for the same marking point
✓	Separates marking points
DO NOT ALLOW	Answers which are not worthy of credit
IGNORE	Statements which are irrelevant
ALLOW	Answers that can be accepted
()	Words which are not essential to gain credit
—	Underlined words must be present in answer to score a mark
ECF	Error carried forward
AW	Alternative wording
ORA	Or reverse argument

INTRODUCTION

Your first task as an Examiner is to become thoroughly familiar with the material on which the examination depends. This material includes:

- the specification, especially the assessment objectives
- the question paper
- the mark scheme.

You should ensure that you have copies of these materials.

You should ensure also that you are familiar with the administrative procedures related to the marking process. These are set out in the OCR booklet **Instructions for Examiners**. If you are examining for the first time, please read carefully **Appendix 5 Introduction to Script Marking: Notes for New Examiners**.

Please ask for help or guidance whenever you need it. Your first point of contact is your Team Leader.

Question	Answer	Marks	AO Element	Guidance
<p>1 (a)</p>	<p>Any 2 labels correct ✓ 3 or 4 correct ✓✓ 5 or 6 correct ✓✓✓</p>	<p>3</p>	<p>AO1.1a AO1.1c</p>	

1	(b)	(i)	<table border="1" data-bbox="423 197 1498 715"> <thead> <tr> <th></th> <th>Rock A</th> <th>Rock B</th> <th>Rock C</th> </tr> </thead> <tbody> <tr> <td>Crystal size (fine / medium / coarse)</td> <td>Coarse</td> <td>Coarse crystals in fine groundmass</td> <td>Not visible</td> </tr> <tr> <td>Texture</td> <td>Equicrystalline / Equigranular</td> <td>Porphyritic</td> <td>Glassy</td> </tr> <tr> <td>Colour</td> <td>Black and white / grey and white / dark greenish grey and white</td> <td>Pink / Red / Brown</td> <td>Black</td> </tr> <tr> <td>Rock type</td> <td>Gabbro</td> <td>Rhyolite / Porphyritic Rhyolite</td> <td>Obsidian</td> </tr> </tbody> </table> <p data-bbox="353 759 999 794">1 mark for each correct row in the table; ✓✓✓</p>		Rock A	Rock B	Rock C	Crystal size (fine / medium / coarse)	Coarse	Coarse crystals in fine groundmass	Not visible	Texture	Equicrystalline / Equigranular	Porphyritic	Glassy	Colour	Black and white / grey and white / dark greenish grey and white	Pink / Red / Brown	Black	Rock type	Gabbro	Rhyolite / Porphyritic Rhyolite	Obsidian	4	AO2.1b AO3.1a AO3.1e	<p data-bbox="1821 164 2107 325">Crystal size AO2.1b Texture AO3.1a Colour AO3.1a Rock type AO3.1e</p> <p data-bbox="1821 376 2107 537">ALLOW 1 Mark for any correct column If NO rows are accurate</p> <p data-bbox="1821 588 2107 663">ALLOW orange for Rock B</p> <p data-bbox="1821 715 2107 790">ALLOW diorite for rock A</p> <p data-bbox="1821 802 2107 877">ALLOW porphyry for rock B</p>
	Rock A	Rock B	Rock C																							
Crystal size (fine / medium / coarse)	Coarse	Coarse crystals in fine groundmass	Not visible																							
Texture	Equicrystalline / Equigranular	Porphyritic	Glassy																							
Colour	Black and white / grey and white / dark greenish grey and white	Pink / Red / Brown	Black																							
Rock type	Gabbro	Rhyolite / Porphyritic Rhyolite	Obsidian																							
1	(b)	(ii)	<p data-bbox="353 930 613 965"><u>Any 3 valid points:</u></p> <p data-bbox="353 1016 703 1051">M1 Accurate scale bar ✓</p> <p data-bbox="353 1058 1435 1093">M2 Accurate crystal size drawn according to their scale 1- 3cm in diameter ✓</p> <p data-bbox="353 1144 857 1179">M3 Accurate crystal shape drawn ✓</p> <p data-bbox="353 1230 936 1265">M4 Groundmass / fine <u>crystals</u> labelled ✓</p> <p data-bbox="353 1272 972 1307">M5 Phenocrysts / coarse <u>crystals</u> labelled ✓</p> <p data-bbox="353 1358 781 1393">M6 Euhedral shape labelled ✓</p> <p data-bbox="353 1399 815 1434">M7 Porphyritic texture labelled ✓</p>	3	AO2.1b	<p data-bbox="1821 930 2074 1046">Any part of hand specimen may be drawn.</p>																				

1	(b)	(iii)	<p><u>Both have (similarities):</u></p> <p>M1 One stage of cooling / Glassy – single stage of cooling AND Equigranular – single stage of cooling ✓</p> <p><u>Differences:</u></p> <p>M2 Gabbro is intrusive / plutonic in origin AND Obsidian is Extrusive / Volcanic ✓</p> <p>M3 Gabbro is slow-cooling AND Obsidian is fast cooling ✓</p> <p>M4 Gabbro is mafic AND Obsidian is silicic / Gabbro has 44-52% Silica content AND Obsidian >66% ✓</p> <p>M5 Gabbro forms at Divergent Plate Margins AND Obsidian at Convergent ✓</p>	3	AO3.1a AO3.1e	<p>Comparison must be made to gain credit (not a simple list for each)</p> <p>1 mark MAX for similarity</p> <p>MAX 2 marks for differences only</p> <p>ALLOW ECF from 1 b (i) if misidentified for 1 mark MAX</p>
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1	(c)	*	<p>Level 3 (5–6 marks)</p> <p>Accurately places geological features from the diagram in chronological order with detailed explanations of how they link to the rock cycle AND relative dating laws to support their answer e.g. superposition / cross-cutting relationships / included fragments / original horizontality.</p> <p><i>There is a well-developed line of reasoning which is clear and logically structured. The information presented is relevant and substantiated.</i></p> <p>Level 2 (3–4 marks)</p> <p>Places some geological features in chronological order AND attempts to link their formation to the rock cycle OR relative dating</p> <p><i>There is a line of reasoning presented with some structure. The information presented is relevant and supported by some evidence.</i></p> <p>Level 1 (1–2 marks)</p> <p>Attempts to place some geological features in chronological order OR attempt to identify parts of the rock cycle OR some ideas about relative dating in which some of the rock units are formed.</p> <p><i>There is an attempt at a logical structure with a line of reasoning. The information is in the most part relevant.</i></p> <p>0 marks</p> <p><i>No response or no response worthy of credit.</i></p>	6	<p>AO1.1a AO1.1c AO2.1a AO3.1a AO3.1b</p> <p><u>Content may include:</u> <u>Rock Cycle:</u></p> <p>Deposition of sedimentary layers / burial / compaction / cementation / diagenesis to form sedimentary rocks followed by tilting / folding / deformation</p> <p>Intrusion of granite discordantly / stoping / assimilation to metamorphose country rocks and form a metamorphic aureole and contact metamorphism / recrystallisation of country rocks</p> <p>Period of uplift and erosion to expose granite and country rock forming an angular unconformity.</p> <p>Deposition of upper series unconformably to include eroded granite material</p>
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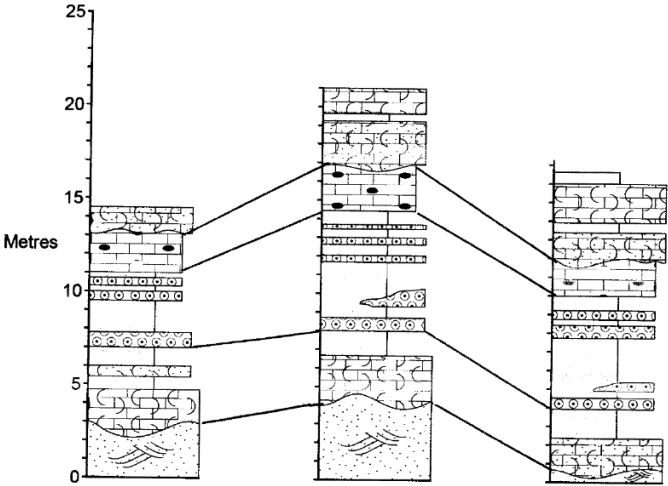
					<p><u>Relative Dating:</u></p> <p>Principle of Superposition; O, M, K, J, G, E/N, L, I, H and F, (granite, metamorphic rocks) D, C, B and A</p> <p>Principle of Original Horizontalilty; lower series rock O must be oldest unless inverted</p> <p>Law of Cross Cutting Relationships; Granite intrudes and cuts across country rock / Metamorphic Aureole</p> <p>Law of included Fragments; Xenoliths / inclusions of country rock in the granite / fragments of Granite in bed D</p> <p><u>Other valid points which may be present:</u> Comments re environments of deposition of Sedimentary rocks</p>
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Question			Answer	Mark	AO Element	Guidance
2	(a)	(i)	<p>First check the answer on the answer line. If answer = 29(%) award 2 marks</p> $\text{percentage change} = \frac{\text{new quantity} - \text{original quantity}}{\text{original quantity}} \times 100$ <p>M1 (54-42) / 42 x 100 = 28.57 ✓ M2 29% to 2 SF ✓</p>	2	AO2.1b	<p>1 mark for correct working</p> <p>ALLOW 28.6 for M1</p> <p>DO NOT ALLOW 28</p>
2	(a)	(ii)	<p>First check the answer on the answer line. If answer = 0.5 (°C cm⁻¹) award 2 marks</p> <p>Calculate the difference in temperature between B and C (5°C) and divide by 10 cm.</p> <p>M1 (25-20=5)/10 ✓ M2 0.5 (°C cm⁻¹) ✓</p>	2	AO2.1b	<p>1 mark for correct working</p> <p>ALLOW the rate of temperature change given as a positive or negative answer</p>
2	(a)	(iii)	<p>M1 Heat transfer would be quicker ✓ M2 Water filling pore spaces would act as a conduit / water is better at transferring heat / water is a more efficient conductor of heat ✓</p>	2	AO3.1c	<p>1 mark for identifying the difference 1 mark for explanation of difference</p>

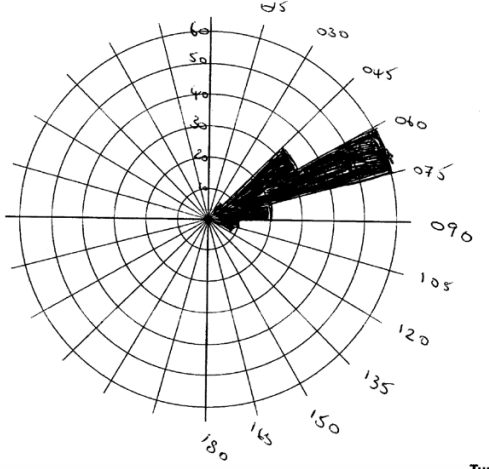
2	(a)	(iv)	<p>M1 Unknown temperature of immersion heater / efficiency of immersion heater ✓</p> <p>M2 Variation in temperature of surroundings during the experiment ✓</p> <p>M3 Accuracy of thermometers ✓</p> <p>M4 Issue with thermometers or can remaining upright in the sand / difficulties ensuring all the thermometer bulbs are at the same depth within the sand ✓</p> <p>M5 Water inside the can may drop in temperature before experiment has started ✓</p> <p>M6 Total time of experiment not long enough for heat transfer ✓</p> <p>M7 Difficulties accurately measuring the distance between the thermometers ✓</p> <p>M8 Variations in the size of sand grains / composition of grains ✓</p>	3	AO3.1a	Any 3 valid ideas
2	(b)	(i)	<p>M1 Foliation / schistosity / aligned platy minerals / micas / biotite / muscovite aligned ✓</p> <p>M2 Porphyroblastic / garnet porphyroblasts ✓</p>	2	AO2.1b	
	(b)	(ii)	Schist	1	AO1.1a	

2	(b)	(iii) *	<p>Level 3 (5–6 marks)</p> <p>Clear links between metamorphic facies / conditions of metamorphism e.g. appropriate temperatures and pressures with the formation of mica foliation and recrystallisation to form garnet porphyroblasts. Specific values / ranges of temperature and pressure may be given. Explains that these conditions lead to the formation of new minerals e.g. Index minerals and/ or changing stability of minerals and maybe outlines why this cannot occur due to contact metamorphism.</p> <p><i>There is a well-developed line of reasoning which is clear and logically structured. The information presented is relevant and substantiated.</i></p> <p>Level 2 (3–4 marks)</p> <p>Some links are made between pressure and temperature conditions and foliated texture and / or porphyroblastic texture. Some awareness of growth of new minerals. Mentions medium grade / medium temperature / medium pressure to form regional metamorphism rock / facies</p> <p><i>There is a line of reasoning presented with some structure. The information presented is relevant and supported by some evidence.</i></p> <p>Level 1 (1–2 marks)</p> <p>Simple ideas that increased temperatures and / or pressure are required to form Regional Metamorphic rocks and / or simple ideas about new minerals / textures forming. May state high temperature / pressure instead of medium.</p> <p><i>There is an attempt at a logical structure with a line of reasoning. The information is only partially relevant.</i></p>	6	AO1.1c AO2.1a AO3.1c	<p><u>Content may include:</u></p> <p><u>Mineralogy:</u> Barrovian Index minerals are Garnet and Biotite mica indicating medium grade. Absence of Kyanite / Sillimanite at high grade or Chlorite changed into Biotite as grade increases</p> <p><u>Texture:</u> Requires medium directed pressure to align minerals / foliation / perpendicular to pressure / form Schistosity / medium sized crystals ALLOW values around 300-500 MPa</p> <p>Medium temperature allows growth of Garnet porphyroblasts / large porphyroblasts indicate long duration of metamorphism ALLOW values around 300-500° C</p>
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			<p>0 marks No response or no response worthy of credit.</p>		<p><u>Conditions of metamorphism:</u> Medium temperature / Medium grade to form garnet / parent rock should be rich in clay minerals / clay minerals become unstable and change to biotite and/or garnet Greenschist Facies</p> <p>Regional Metamorphism not Contact due to mineral re-alignment. Medium pressure to form schistosity</p> <p><u>Tectonic Setting:</u> Convergent plate margins / collision zones / orogenic belts / fold mountain belts / deep underground</p> <p><u>Check answer for 2bii:</u> ALLOW responses which refer to a higher metamorphic grade if candidates answered Gneiss OR a lower grade if they answered Slate</p>
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Question	Answer	Mark	AO Element	Guidance
<p>3 (a) (i)</p>	<p><u>Any 3;</u></p> <p>M1 Base of lower Shelly Limestone / Top of the cross stratified Sandstone (lower erosive surface) ✓</p> <p>M2 Base of the lowest Oolitic Limestone ✓</p> <p>M3 Base of the Limestone containing Nodules ✓</p> <p>M4 Base of upper Shelly Limestone / Top of the Limestone containing Nodules (upper erosive surface) ✓</p>  <p>M1 1 or 2 correct lines ✓</p> <p>M2 3 correct lines ✓✓</p>	<p>2</p>	<p>AO2.1b</p>	<p>Lines must correlate AND connect to all 3 sections;</p> <p>ALLOW; lines not drawn with a ruler</p>

3	(a)	(ii)	<p><u>Any Two:</u></p> <p>M1 Varying Rates of sedimentation producing variation in thickness of beds ✓</p> <p>M2 Diachronous beds / zone fossils could die out during deposition of a diachronous rock ✓</p> <p>M3 Erosion so some cycles / rocks / units are missing ✓</p> <p>M4 Lateral variation in beds / wedging out of beds meaning beds appear in some logs and not others / different sedimentary environments may occur in different parts of the basin resulting in different rocks OR fossils ✓</p> <p>M5 Planktonic or nektonic zone fossils could be found in a variety of different facies / rock types / ✓</p> <p>M6 Derived Fossils / idea of fossil eroded from an older rock and deposited in a younger ✓</p>	2	AO1.1c AO3.1c	ALLOW; rock / unit / bed / layer
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3	(b)	(i)	 <p>M1 Appropriate Frequency scale AND orientations labelled ✓</p> <p>M2 Accurate plot ✓</p>	2	AO2.1b	<p>Degrees labelled with 4 or more orientations OR 4 compass points</p> <p>The scale can be placed on any of the spokes of the circle.</p> <p>Candidates can achieve full marks whether they plot both sides or half of the rose diagram.</p> <p>ALLOW 1 plotting error for M2</p> <p>ALLOW orientations as 2 figure numbers for M1</p> <p>DO NOT ALLOW M2 if there is no scale on one of the spokes of the circle</p>
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3	(b)	(ii)	<p><u>Current direction;</u></p> <p>M1 ENE / WSW / current flowed from ENE to WSW ora ✓</p> <p><u>Explanation;</u></p> <p>M2 Palaeocurrents had sufficient energy to align the Belemnites / concept of some energy present to cause alignment ✓</p> <p>M3 Fossils align with long axes / guard long axes parallel to the current direction / align to line of least resistance parallel to current ✓</p>	2	AO3.1b	<p>ALLOW ECF; 1 mark for current direction</p> <p>DO NOT ALLOW; NE / SW unless ECF for M1</p> <p>DO NOT ALLOW; high energy for M2 as Belemnites are relatively intact</p>
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<p>3</p>	<p>(b)</p>	<p>(iii)</p>	<p>M1 Axes correctly labelled ✓</p> <p>M2 Accurate plot of 6 bars ✓ ✓</p> <p>Draw a histogram of the results from the table on the grid.</p>	<p>3</p>	<p>AO2.1b</p>	<p>X Axis can be labelled 0-10,11-20, etc. between lines as class widths OR as numbers below lines as shown in diagram</p> <p>Max marks require full histogram drawn</p> <p>ALLOW 1 plotting error</p> <p>DO NOT ALLOW M1 if scale is non-linear</p> <p>DO NOT ALLOW M2 if bars are not touching</p> <p>ALLOW if Y axis labelled Frequency density (0-5) & points plotted correctly (0.5, 1.5 etc)</p>
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3	(b)	(iv)	Skewed distribution / Negative skew / shape of graph described e.g. peak of the graph is to the right of centre	1	AO3.1a	ALLOW ECF
3	(b)	(v)	<p><u>Palaeoenvironment 1 mark max;</u></p> <p>M1 Marine environment of deposition (due to presence of Belemnites) / low energy marine due to fine grained rock ✓</p> <p>OR</p> <p>M2 Shallow marine / shelf environment (50-200m deep) / deeper continental shelf / slope environment ✓</p> <p><u>Any three from:</u></p> <p>M3 A current was present which may have removed smaller belemnites / dominance of longer Belemnites (shown by frequency distribution graph / histogram) ✓</p> <p>M4 Current flowed ENE or WSW / uni-directional current / rose diagram shows ENE-WSW direction ✓</p> <p>M5 Clear alignment of fossils could indicate a current / turbidite deposit / formed as part of a turbidity current / part of a Bouma sequence ✓</p> <p>M6 Death assemblage –due to having sunk after death ✓</p> <p>M7 Belemnites were Nektonic/ lived in the water column ✓</p>	4	AO1.1a AO1.1c AO3.1d	

Question	Answer	Mark	AO Element	Guidance
<p>4 (a)</p>	<p><u>Any 5 correct:</u></p> <p>M1 Labelling of 3 or more rock units with names from stratigraphic column or other appropriate key ✓</p> <p>M2 Boundary of igneous intrusion to show irregular / steep contact ✓</p> <p>M3 Metamorphic aureole present parallel to granite contact AND labelled ✓</p> <p>M4 4 faults correctly plotted dipping east AND labelled / 4 faults plotted vertically with downthrow side indicated to the left AND labelled ✓</p> <p>M5 Downthrow of sedimentary rocks to the east correctly drawn across one fault ✓</p> <p>M6 Correct Dip of beds plotted 30-40 degrees in the Devonian GKG and SAG OR 25 degrees in the Permian BRLB ✓</p> <div data-bbox="353 970 1460 1417" style="text-align: center;"> </div> <p style="text-align: right;">[5]</p>	<p>5</p>	<p>AO2.1b AO3.1b</p>	<p>ALLOW use of abbreviations from the map e.g. BRLB OR names from the key e.g. Brodick Beds OR rock types named in the key e.g. Breccia & dune cross bedded sandstones</p> <p>DO NOT ALLOW labelling of GKG as LMW OR CRLM as these labels have arrows indicating beds in another part of the map OR LSC for SAG OR KD for Granite</p> <p>ALLOW plotting of granite boundary as vertical as no structural information is on the map</p> <p>ALLOW vertical plotting of faults Dip angles +/- 5°</p>

4	(b)	<p><u>Any two:</u></p> <p>M1 Faults allow water ingress and can flood the area of extraction / faults can displace coal making extraction more difficult / uneconomic / faults could re activate due to mining activity ✓</p> <p>M2 (30°) dip of rocks results in rock instability / could cause landslides / is too steep for machinery to extract coal ✓</p> <p>M3 Rock formation is not all coal making it less economic to extract ✓</p> <p>M4 Presence of mudstones/ less competent rocks which could cause sides to collapse / presence of sandstone which could be permeable could lead to water ingress ✓</p> <p>M5 Subsidence AND due to cavities in the limestone (below the coal measures)</p>	2	AO2.1a	<p>DO NOT ALLOW limestone permeability for M4 as Limestone dips below the coal measures</p>
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