GCE

Geology

H014/01: Geology

AS Level

Mark Scheme for June 2025

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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.

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 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 available in RM Assessor.

3. Log-in to RM Assessor and mark the **required number** of practice responses ("scripts") and the **required number** of standardisation responses.

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 50% 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, email or via the RM Assessor messaging system.

5. Work crossed out:

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. There is a NR (No Response) option. Award NR (No Response)

- if there is nothing written at all in the answer space
- OR if there is a comment which does not in any way relate to the question (e.g. 'can't do', 'don't know')
- OR if there is a mark (e.g. a dash, a question mark) which isn't an attempt at the question.

Note: Award 0 marks – for an attempt that earns no credit (including copying out the question).

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 email.

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.

Levels of response questions on this paper are **21(c)(i)** and **23(d)(ii)**.

11. Annotations available in RM Assessor

Annotation	Meaning
	Correct
	Incorrect
	Omission/missing information
	Benefit of doubt given
	Contradiction
	Rounding Error
	Error in number of significant figures
	Error carried forward
	Level 1 (in levels of response question)
	Level 2 (in levels of response question)
	Level 3 (in levels of response question)
	Benefit of doubt not given
	Seen (to show content on a page has been noted, but not credited)
	Ignore
	Blank page

12. 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

13. **Subject-specific Marking Instructions**

INTRODUCTION

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

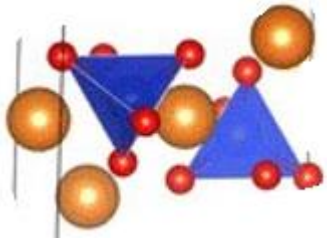
- the specification, especially the assessment objectives
- the question paper
- the mark scheme.

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**.

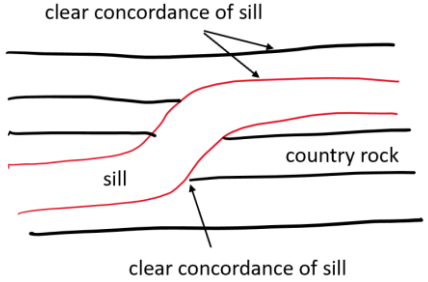
Please ask for help or guidance whenever you need it. Your first point of contact is your Team Leader.

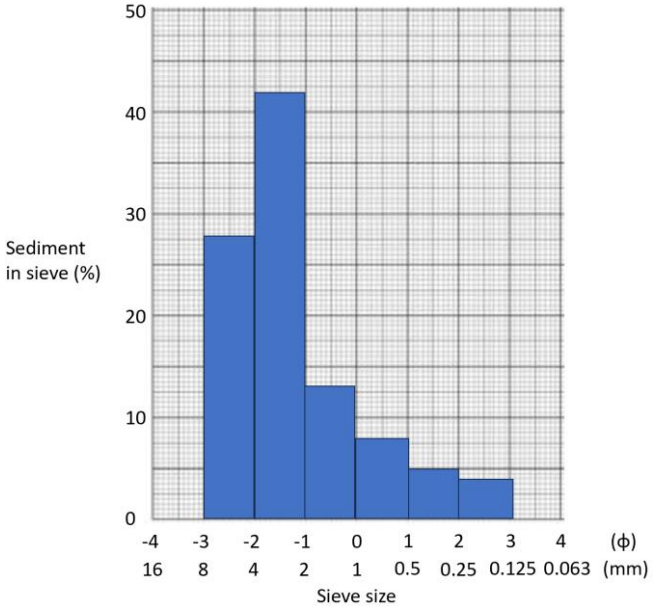
Question	Answer	Mark	AO element	Guidance
1	**B –** Hydrogen ✓	1	1.1a	
2	**B** – Core ✓	1	1.1a	
3	**C** – Lithophile ✓	1	1.1a	
4	**D** – Quartz ✓	1	1.1a	
5	**A** – Diagram **A** ✓	1	2.1b	
6	**C** – Diagram **C** ✓	1	2.1b	
7	**D** – Diagram **D** ✓	1	2.1a	
8	**D** – Uniformitarianism ✓	1	1.1a	
9	**B** – Temperature of syrup ✓	1	1.1d	
10	**B** – Benioff zone ✓	1	2.1a	
11	**D** – Subduction ✓	1	2.1a	
12	**B** – Strong positive ✓	1	1.1d	
13	**C** – Contraction ✓	1	1.1a	
14	**D** – Systematic ✓	1	2.1b	
15	**C** – 9 ✓	1	2.1b	
16	**A** – 48° ✓	1	2.1b	
17	**D** – Sampling technique ✓	1	1.1c	
18	**D** – Curve **4** ✓	1	1.1c	
19	**A** – 6 Ma ✓	1	2.1a	
20	**C** – 24 Ma ✓	1	2.1a	

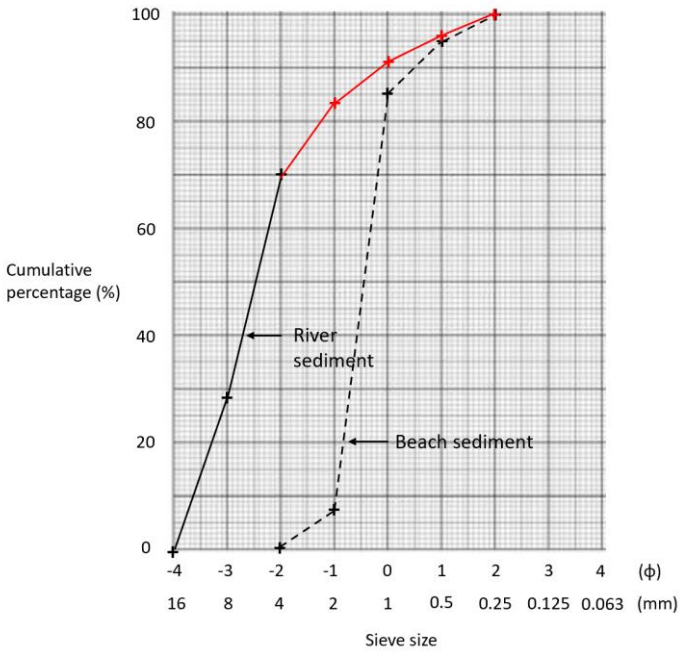
Question			Answer	Mark	AO Element	Guidance
21	(a)	(i)	Naturally occurring element / compound / substance ✓ Fixed chemical composition / pure substance ✓ Crystalline structure / form crystals ✓	**MAX 2**	1.1a	**ALLOW** inorganic **DO NOT ALLOW** organic
21	(a)	(ii)	Calcite ✓ Does not contain Si / silicon ✓	**2**	1.1c	**ALLOW** silica / SiO_2
21	(b)	(i)	Si:O ratio = 1:3 ✓ Silicate structure = Chain ✓	**2**	1.1d 1.1a	**ALLOW** any reference to chain silicate
21	(b)	(ii)	All SiO_4 tetrahedra bonded together in quartz so harder/ some SiO_4 tetrahedra bonded to Ca / Mg atoms in diopside so softer ✓ Diopside contains (heavier) Ca / Mg atoms so denser **OR** Diopside packed more tightly so denser ✓	**2**	2.1a	**ALLOW** stronger / weaker bonds in quartz / diopside **IGNORE** reference to cleavage **ORA**
21	(b)	(iii)	 Two or more SiO_4 tetrahedra drawn not bonded together by O ✓ Mg atoms drawn matching double the number of SiO_4 tetrahedra drawn ✓	**2**	3.1b	**IGNORE** the orientation of the SiO_4 tetrahedra and relative sizes at the SiO_4 tetrahedra and Mg atoms. **IGNORE** the relative positions of the SiO_4 tetrahedra and Mg atoms. **ALLOW** Si atoms/bonds to be missing inside centre of SiO_4 tetrahedra. **ALLOW** the number of Mg atoms to be in tolerance by ± 1.

Question			Answer	Mark	AO Element	Guidance
21	(c)	(i)*	Please refer to the marking instructions on page 4 of this mark scheme for guidance on how to mark this question. **Level 3 (5–6 marks)** Lists correct equipment to be used **AND** includes a thorough description of the method to be employed in the test. A clear understanding of how to minimise the effect of anomalous results is evident. *There is a well-developed line of reasoning which is clear and logically structured. The information presented is relevant and substantiated.* **Level 2 (3–4 marks)** Lists some correct equipment to be used **AND** includes a good description of the method to be employed in the test. An attempt to discuss how to minimise the effect of anomalous results is evident. **OR** Lists correct equipment to be used **AND** includes a thorough description of the method to be employed in the test. No discussion of how to minimise the effect of anomalous results is evident. *There is a line of reasoning presented with some structure. The information presented is relevant and supported by some evidence.* **Level 1 (1–2 marks)** May list some equipment to be used **AND** includes a partial description of the method to be employed in the test. An attempt to discuss how to minimise the effect of anomalous results may be present. **OR**	**6**	1.1b x 4 3.1f x 2	**Indicative scientific points could include the following points and explanations:** **<u>Equipment:</u>** Density test – Balance and measuring cylinder Balance and use of a displacement can / eureka can and measuring cylinder Water supply Pure mineral. **<u>Method:</u>** Density test – ▪ Measure mineral's mass (in g) using balance ▪ Fill cylinder with water and find initial volume (in ml) ▪ Add specimen and find final volume (in ml) ▪ Calculate density by dividing mass by displaced water volume. **OR** ▪ Describe use of a Eureka can ▪ Mass/volume = density. **<u>Anomalous results:</u>** Repeat the test at least twice and either discard clearly anomalous results &/or calculate mean. Ensure mineral is dry at start Ensure electronic balance is zeroed / tared before finding mass Avoid splashing water when lowering mineral into measuring cylinder / displacement can Read measuring cylinder horizontally at bottom of meniscus (to avoid parallax error)

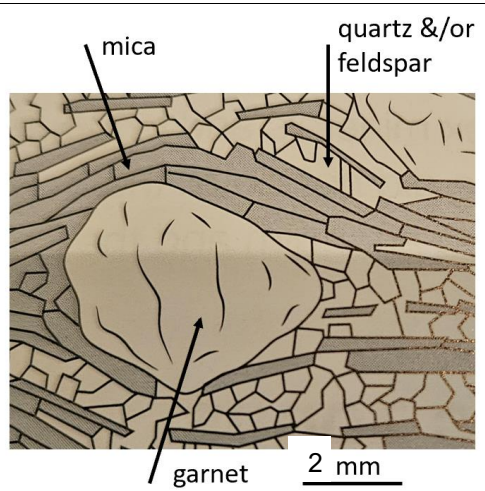
Question			Answer	Mark	AO Element	Guidance
			Lists some correct equipment to be used **AND** includes a good description of the method to be employed in the test. No discussion of how to minimise the effect of anomalous results is evident. *There is an attempt at a logical structure with a line of reasoning. The information is in the most part relevant.* **0 marks -** No response or no response worthy of credit.			
	(c)	**(ii)**	The very close density values of the three minerals makes their distinction unlikely ✓ The identical hardness of the feldspars yet much lower hardness of calcite means only calcite likely to be distinguished from the three ✓ **OR** Calcite can be differentiated as it has a lower hardness ✓ Feldspars cannot be distinguished as similar hardness and density ✓	**2**	3.1d	

Question			Answer	Marks	AO element	Guidance
22	(a)		A = peridotite ✓ B = diorite ✓	2	1.1c	
22	(b)	(i)	Microgranite ✓	1	2.1b	**ALLOW** microgranodiorite
22	(b)	(ii)	Medium sized crystals indicate medium / slow rate cooling (over a few thousand years) ✓ Medium sized crystals indicate cooling at depths of a few km / shallow intrusive ✓ Equicrystalline indicates one stage / rate / depth of cooling ✓	3	2.1a	**Ecf** if granite in 2bi **ALLOW** hypabyssal
22	(c)	(i)	Igneous body is concordant ✓ Igneous body has medium sized / >1mm crystals so is intrusive ✓	2	3.1a	**AW** parallel to bedding plane
22	(c)	(ii)	Two chilled margins on the edges of the igneous body ✓ A baked margin in the mudstone and sandstone ✓ Xenoliths from the sandstone above (and mudstone below) ✓ A regular upper surface to the igneous body ✓ Evidence of gravity settling at the base of the igneous body ✓ **No** weathered top surface of the igneous body ✓ **No** eroded fragments of the sill / microgranite in the overlying sandstone ✓ **No** vesicles in the igneous body / sill ✓	**MAX 4**	1.1c	**ALLOW** baked margins in the country rock **ALLOW** evidence of stoping
22	(d)		 Clear concordance of sill ✓ Clear discordance of sill changing from concordant to discordant to concordant ✓	2	1.1a	**MAX 1** for correct unlabelled diagram / sketch Need at least 2 bedding planes drawn on sketch

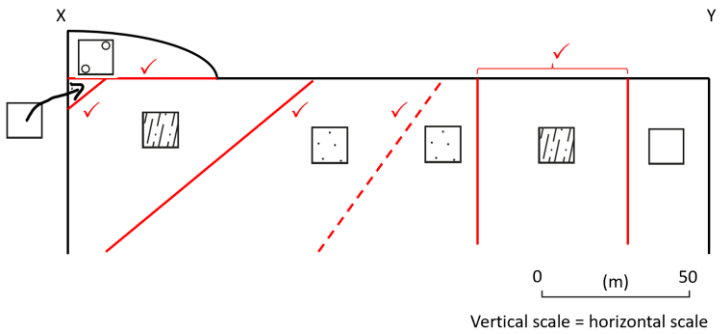
Question			Answer	Marks	AO element	Guidance
23	(a)		Ensure that the sediment is dry ✓ Measure the mass of a (representative) sample ✓ Measure the mass of each individual sieve stack ✓ Place sieve stack in order – coarsest sieve at top and finest at bottom ✓ Place sediment in top coarsest sieve (and put on lid) ✓ Shake/rotate sieve stack for at least 1 minute ✓ Carefully separate sieves (using paper to prevent sediment loss) ✓ Measure the mass of each individual sieve stack with the sediment ✓ Calculate the mass of sediment for each class interval ✓	**MAX 4**	1.1b	**ALLOW** pour sediment into tared receptacle to obtain mass of sediment for each class interval ✓
23	(b)	(i)	 All six bars correctly plotted = 2 marks ✓✓ Four or five bars correctly plotted = 1 mark ✓ Three than less bars correctly plotted = 0 marks	**2**	2.1b	**ACCEPT** histogram **MAX 1** if all points correct but a line graph (points need to be between each pair of ϕ values

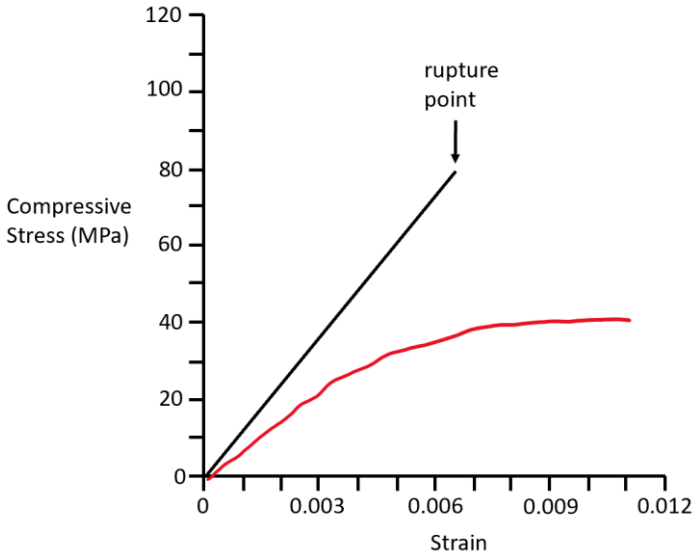
Question			Answer	Marks	AO element	Guidance
23	(b)	(ii)	Poorly sorted / texturally immature ✓ Modal class (most common grain size) between 2 and 4 mm ✓ Range of grain sizes between 0.125 and 8 mm ✓ Skewed grain size distribution ✓ Any quantification of an individual grain size class / range of grain size classes ✓	**MAX 3**	1.1d	**ALLOW** all answers expressed in ϕ units
23	(c)	(i)	-0.4 to -0.5 ϕ ✓	**1**	2.1b	
23	(c)	(ii)	0 ≥ ϕ > -1 ✓	**1**	2.1b	**ALLOW** 0 to -1 **OR** -1 to 0
23	(c)	(iii)	-0.6 to -0.3 ϕ ✓	**1**	2.1b	
23	(d)	(i)	 All four points correctly plotted ✓ Line drawn joining all points ✓	**2**	2.1b	**ALLOW** ½ square tolerance

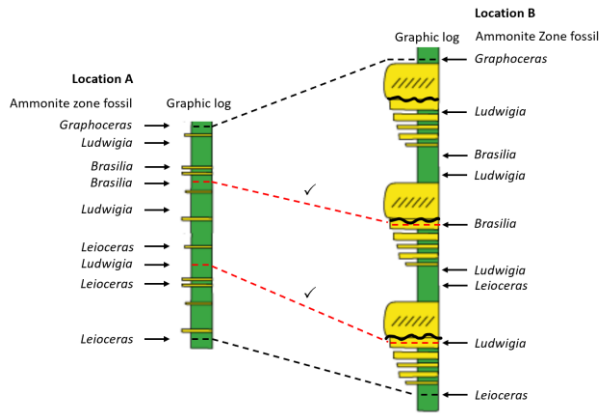
Question			Answer	Marks	AO element	Guidance
23	(d)	(ii)*	Please refer to the marking instructions on page 4 of this mark scheme for guidance on how to mark this question. **Level 3 (5–6 marks)** Gives thorough description of the differences in texture **AND** composition of the beach and river sediments. A clear understanding of the reasons for these textural **AND** mineralogical differences is evident. *There is a well-developed line of reasoning which is clear and logically structured. The information presented is relevant and substantiated.* **Level 2 (3–4 marks)** Gives good description of the differences in texture **AND / OR** composition of the beach and river sediments. An understanding of the reasons for these textural **AND / OR** mineralogical differences is evident. *There is a line of reasoning presented with some structure. The information presented is relevant and supported by some evidence.* **Level 1 (1–2 marks)** Gives a partial description of the differences in texture **AND / OR** composition of the beach and river sediments. An attempt to explain the reasons for these textural **AND / OR** mineralogical differences may be evident. *There is an attempt at a logical structure with a line of reasoning. The information is in the most part relevant.* **0 marks -** No response or no response worthy of credit.	**6**	2.1a x 2 3.1b x 4	**Indicative scientific points could include the following points and explanations:** **<u>Description:</u>** <u>Texture</u> Beach sediment is… • Finer • Better sorted • More rounded and thus more mature …than the river sediment. <u>Composition</u> Beach sediment is more… • Quartz rich • Depleted in feldspar • Lacking in rock fragments • Contains some clay minerals …compared to the river sediment. **<u>Explanation:</u>** Sediment has undergone much greater erosion Longer transport history to reach the beach location. Constant high energy More attrition and abrasion during transport Rock fragments have broken into constituent minerals Feldspar undergoing greater erosion compared to quartz with some feldspar undergoing hydrolysis to form clays Quartz remains as harder and inert.

Question			Answer	Marks	AO element	Guidance
24	(a)	(i)	$CaCO_3 + SiO_2 \rightarrow CaSiO_3 + CO_2$ ✓	1	1.1c	
24	(a)	(ii)	Limestone / sandstone ✓	1	2.1a	**ALLOW** any additional development on limestone or sandstone e.g. impure limestone, calcite cemented sandstone etc.
24	(a)	(iii)	No elements added or removed (during the metamorphic reaction) **OR** the bulk composition remains the same ✓	1	2.1a	**ACCEPT** closed system
24	(b)	(i)	Value = 29 (±2) ✓ Unit = MPa km^{-1} ✓	2	2.1b	(31 – 27) **ALLOW** MPa/km **ACCEPT** Kpa/m **OR** $KPam^{-1}$
24	(b)	(ii)	Regional metamorphic rocks possess a foliation ✓ As they form at greater pressures **OR** subjected to directed pressure / stress ✓	2	2.1a x 1 3.1b x 1	**ORA** for converse argument for all marking points **ALLOW** they form at greater depths **ALLOW** any correct named foliation for regional (slaty cleavage / schistosity / gneissose banding) **OR** unfoliated / granoblastic for contact
24	(b)	(iii)	 Crystalline texture with a porphyroblast ✓ Foliation ✓ Drawn to scale (porphyroblast >2mm **OR** groundmass 1-5mm)✓ Mica and garnet labelled ✓	4	1.1c x 2 2.1a x 2	**DO NOT ALLOW** banding **ACCEPT** biotite/muscovite/kyanite/amphibole

Question			Answer	Marks	AO element	Guidance
24	(c)	(i)	A mineral which indicates / is stable at a specific temperature and pressure conditions ✓	1	1.1a	**ALLOW** a mineral that indicates the metamorphic grade
24	(c)	(ii)	Direction: To the northeast / from SW to NE ✓ Explanation: Gneiss forms at higher grades than slate **ORA** ✓ Kyanite forms at higher grades than chlorite **ORA** ✓	1 2	3.1e x 1 3.1b x 2	**ALLOW** other valid rock comparisons **ALLOW** gneiss forms at the highest grade **ALLOW** other valid index mineral comparisons **ALLOW** kyanite forms at the highest grade

Question			Answer	Marks	AO element	Guidance
25	(a)	(i)	Correct location of U at base of Carboniferous conglomerate ✓ Explanation: Different dip directions of Carboniferous conglomerate and older units ✓ Discordant base to Carboniferous conglomerate ✓ Time gap- Devonian is missing ✓	1 MAX 2	2.1a x 1 3.1a x 2	**ALLOW** reference to different strike directions **ALLOW** conglomerate cuts across older rocks
25	(a)	(ii)	Use clinometer on fault plane until (maximum) dip angle is attained ✓ Measure bearing / direction of (maximum) dip angle using a compass ✓	2	1.1b	**MAX 1** for correct reference to measuring strike to obtain dip direction
25	(b)	(i)	 Horizontal base of Carboniferous conglomerate ✓ Correct position and dip of base of western Ordovician siltstone ✓ Correct position and dip of 'hidden' top of Ordovician siltstone ✓ Correctly labelled position and dip of fault ✓ Vertical top and base of eastern Ordovician siltstone correctly positioned ✓	5	2.1a x 3 3.1b x 2	**ALLOW** a tolerance of 5º for the dip of the bedding and fault planes. **ALLOW** a tolerance of 5mm for the positioning of the bedding and fault planes. **ACCEPT** dashed line for fault

Question			Answer	Marks	AO element	Guidance
25	(b)	(ii)	<u>Fault type:</u> Thrust / reverse ✓ <u>Explanation:</u> Footwall is downthrown / Hanging wall upthrown ✓ Formed by compression ✓	1 2	2.1a x 1 3.1b x 2	
25	(c)	(i)	**FIRST CHECK THE ANSWER ON ANSWER LINE** **If answer = in the range of <u>1.1 x 10^4 to 1.3 x 10^4</u> (MPa) award 2 marks** 80 ÷ 0.0065 ✓ 1.2 x 10^4 (MPa) ✓	2	2.1b	**ALLOW** any value in the range 1.1 x 10^4 to 1.3 x 10^4 **ALLOW** any correct pair of values from graph **IGNORE** number of significant figures
25	(c)	(ii)	Fault breccia ✓ Dynamic metamorphism occurs ✓ Sandstone is brittle when deformed ✓ Forms angular fragments	3	2.1a x 1 3.1b x 2	**ACCEPT** mylonite / fault gouge **ACCEPT** intense deformation causes foliation **ALLOW** sandstone is competent
25	(c)	(iii)	 Strength is reduced ✓ Zone of plastic deformation is apparent and rupture point beyond 0.007✓	2	2.1b	

Question			Answer	Marks	AO element	Guidance
26	(a)	(i)	All the characteristics of a sedimentary rock that are produced by the environment of deposition ✓	1	1.1a	**ALLOW** a definition that includes more than one characteristics such as mineral content, grain size, sedimentary structures or fossil content
26	(a)	(ii)	Facies types: **1** and **2** Explanation: Both were deposited in a (shallow) marine environment ✓	1	2.1a	**ALLOW** marine sandstone and marine mudstone **ALLOW** shallow siliciclastic sea
26	(a)	(iii)	Location: **A** ✓ Explanation: Sediments are finer grained at **A** (hence lower energy and deeper water) ✓ Less sandstone at **A** / no non-marine sandstone at **A** ✓ All the sediments are (shallow) marine at **A** ✓	1 **MAX 1**	2.1a	**ORA** **ALLOW B** contains non-marine sandstone
26	(b)	(i)	*Brasilia* because it has the shortest time duration ✓	1	2.1a	
26	(b)	(ii)	 Correct position of first appearance of Ludwigia ✓ Correct position of first appearance of Brasilia ✓	2	2.1a	**MAX 1** if more than 2 lines drawn and 2 correct

Question			Answer	Marks	AO element	Guidance
26	(b)	(iii)	**Yes** as found in both sandstones and mudstones **OR Yes** as found in different / multiple marine environments ✓ **No** as not found in non-marine successions ✓	**2**	3.1c	
	(c)		**Facies 1 / Marine mudstone:** Life assemblage / articulated / undamaged (thin-shelled) body fossils / indicates low energy conditions ✓ Life assemblage / articulated indicates limited (post-mortem) transport / erosion / below wave base / deeper marine ✓ (Feeding) trail indicates low sedimentation rates / soft / muddy / fine grained / low energy ✓ **Facies 2 / Marine sandstone:** Death assemblage / disarticulated / damaged (thick-shelled / robust) indicates high energy conditions ✓ Death assemblage / disarticulated indicates significant (post-mortem) transport / erosion / above wave base / littoral zone ✓ Vertical (escape) burrow indicates high sedimentation rates / soft sand / protection from high energy ✓	**MAX 2** **MAX 2**	3.1b	**IGNORE** any reference to mudstone or sandstone and energy conditions **ALLOW** one mark for suggesting trace fossil indicates oxygenated environment **ALLOW** one mark for trace or body fossil indicates marine environment **MAX 1** for correctly linking preservation of body fossils to energy if facies not indicated

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