GCE

Geology

H414/03: Practical skills in geology

A Level

Mark Scheme for June 2023

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It is also responsible for developing new specifications to meet national requirements and the needs of students and teachers. OCR is a not-for-profit organisation; any surplus made is invested back into the establishment to help towards the development of qualifications and support, which keep pace with the changing needs of today's society.

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 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.

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 **2(c)** and **5(d).**

10. **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

Annotation	Meaning
I	Ignore
BP	Blank page

11. **Subject Specific Marking Instructions**

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

Annotation	Meaning
I	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

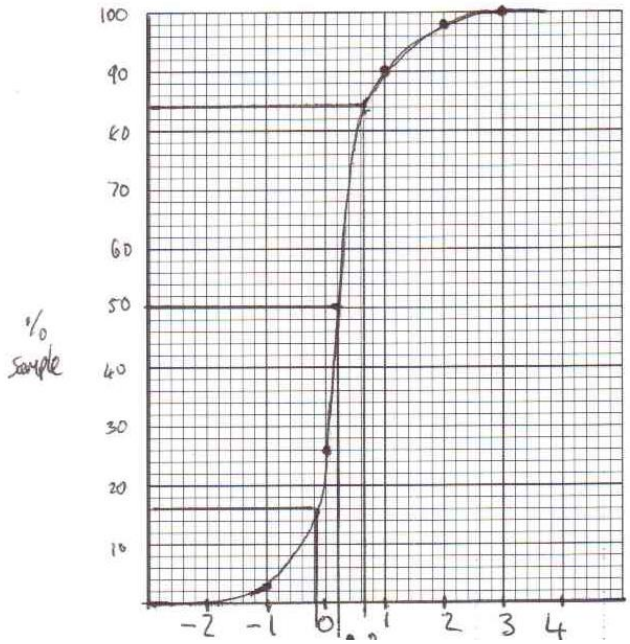
Your first task as an Examiner is to become thoroughly familiar with the material on which the examination depends. This material includes:

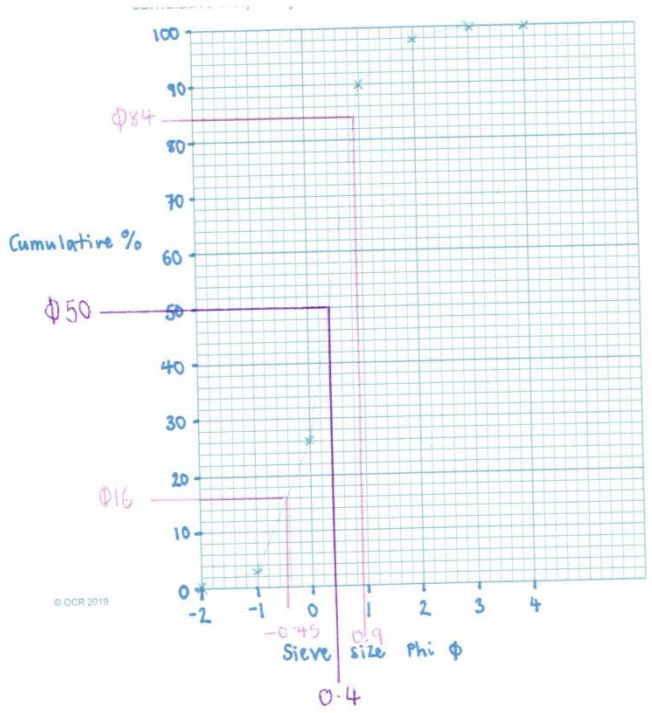
- the specification, especially the assessment objectives
- the question paper
- the mark scheme.

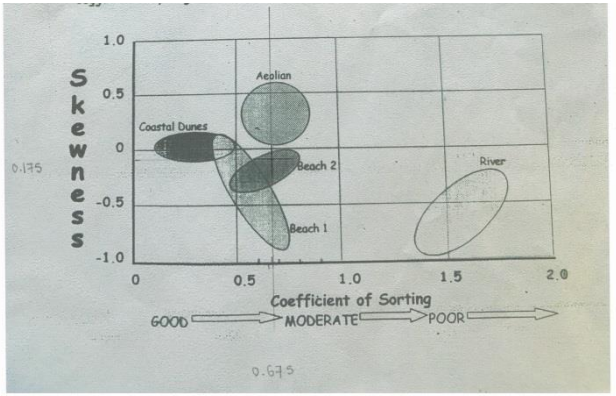
You should ensure that you have copies of these materials.

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**.

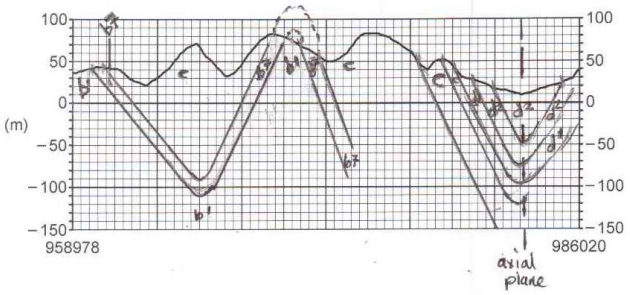
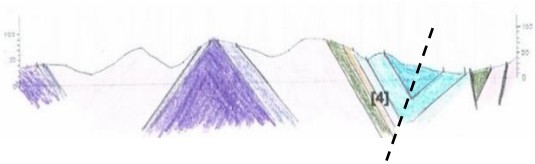
Please ask for help or guidance whenever you need it. Your first point of contact is your Team Leader.

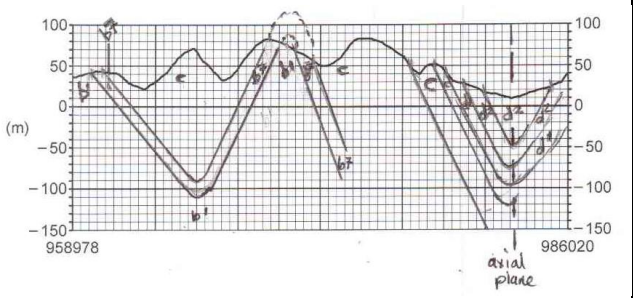
Question			Answer	Marks	Guidance	AO Element
1	(a)		x axis and y axis correctly labelled ✓ Points correctly plotted ✓ Line correctly drawn ✓	3	ALLOW; Tolerance +/- 0.5 of a square for points ALLOW; max 1 wrong plot for 1 mark 	2.1b

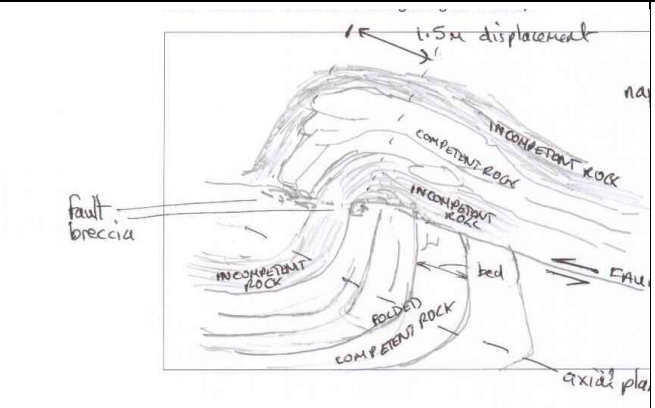
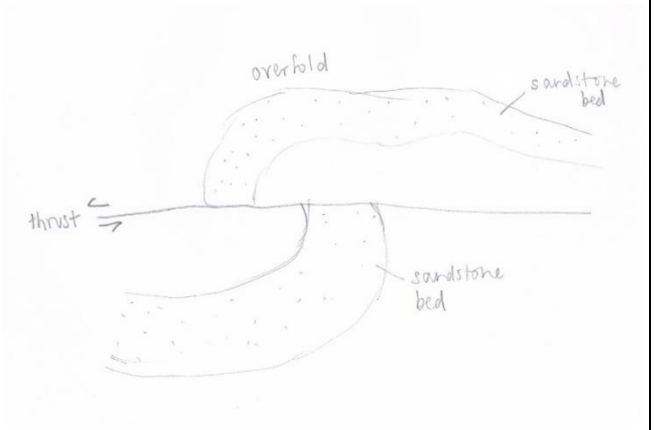
Question			Answer	Marks	Guidance	AO Element
1	(b)		**First check the answer on the answer line.** **If answer = -0.175 award 2 marks** $\frac{(0.9 + (-0.45)) - (2 \times 0.4)}{2}$ ✓ $= \frac{0.45 - 0.8}{2}$ $= \frac{-0.35}{2}$ -0.175 ✓	2	 **ALLOW answer between -0.2 and -0.15 (as phi 16 can be read as -0.4 or -0.5)** **ALLOW tolerance of +/- 0.1 on phi values** **ALLOW ECF** if plotting was wrong but answer to calculation is correct **ALLOW ECF** if the values used for phi 16, 50 and 84 differ to those shown on the left BUT are correct from the candidates graph in Que 1a	2.1b

Question			Answer	Marks	Guidance	AO Element
1	(c)		Beach 2 ✓	1	 **ALLOW** Aeolian OR Beach 1 ONLY as ECF if calculation is incorrect in 1b but the environment plotted is correct for that value	3.1b
1	(d)		*Any 3 from:* Medium sand / arenaceous / 0.125- 2mm ✓ Sub-rounded / rounded / well rounded / texturally mature ✓ Quartz rich / lacks less stable mineral grains e, g, feldspar / mature composition ✓ shells (fragments) ✓	Max 3	**ALLOW** reference to grain size having some coarser material / pebbles **ALLOW ECF** if the answer to 1c was Aeolian and appropriate Aeolian features are described IGNORE sorting and skewness as in question	2.1a

Question			Answer	Marks	Guidance	AO Element
1	(e)		Only a single sample analysed ✓ Doesn't take composition / grain shape of the sediment into account ✓ Doesn't use fossil content which can help identify the environment of deposition ✓ Sieving is a good way to get quantifiable data to plot an environment ✓ Errors during sieving may lead to inaccurate results & incorrect environment identified ✓	2		3.1c

Question			Answer	Mark	Guidance	AO Element
2	(a)	(i)	Accurate plotting of 3 or more beds within at least 2 fold structures ✓ Key/ correct labelling / correct name or colour annotated for rocks present ✓ Extrapolation of syncline in the NE below ground✓ Drawing of Antiform structure above ground ✓ Correct dip for one of the fold structures; SW Syncline of 55º AND 65º +/- 5º **OR** Anticline 65º and 80º +/- 5º **OR** NE Syncline 70º and 60º +/- 5º ✓ Unconformity drawn / labelled between c (Devonian) and c (Carboniferous) ✓ label alluvium OR draw it is as horizontal ✓	Max 5		2.1b 3.1c
2	(a)	(ii)	Line drawn equating to plane of syncline✓	1		3.1b

Question			Answer	Mark	Guidance	AO Element
					 **ALLOW** a vertical fold axis as shown in diagram above	
2	**(a)**	**(iii)**	Any **two** points from: Syncline in the NE AND Asymmetrical **OR** Open fold / dips 70 º AND 60 º ✓ Anticline AND Asymmetrical **OR** closed / limbs dip 65º and 80º ✓ Syncline in the SW AND Asymmetrical **OR** Open fold **/** dips 55 º AND 65 º ✓ Unconformity AND Angular OR Devonian dips 75 º Carboniferous 67 º ✓	Max 2	ALLOW synform / antiform Name of structure and a reason needed for 1 mark ALLOW 1 mark max for 2 **different** named structures but no description	2.1a

Question			Answer	Mark	Guidance	AO Element
2	(b)	(i)	Clear sketch of the fold with scale shown scale ✓ Any **TWO** correct labels from; Incompetent AND Competent rocks Fault Plane / thrust fault Fold axis/ fold axial plane Displacement indicated correctly Measurement of fault displacement 2m Nappe Recumbent fold Tension joints Measurement of angle of Fault lane at 25 º +/- 5 º ✓	2	 	2.1b

Question			Answer	Mark	Guidance	AO Element
2	(b)	(ii)	**Three** responses in correct order from: Set compass to clinometer mode / align dial E/W (so angle measurer swings freely) ✓ Place the clinometer (vertically) on the bedding plane and move around until dip is 0° ✓ Draw a line along the long edge of the clinometer/ draw the strike line (using pencil or chalk) ✓ Hold the compass-clinometer horizontally (to use the compass) and align edge with line ✓ Turn the dial so red arrow and needle line up ✓ Strike should be recorded as three figures in degrees from North / read 3 figure strike bearing from either end of the dial ✓	Max 3	**ACCEPT** correctly drawn and annotated diagram for a maximum of 2 marks	1.1d 2.1a

Question			Answer	Mark	Guidance	AO Element
2	(c)		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 a detailed evaluation of a range of geological problems that would affect the quarrying of limestone, linking knowledge and understanding of geological structures. *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 an outline of some of the geological problems that would affect the quarrying of limestone, linking some knowledge and understanding of geological structures. *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 basic outline of some of the geological problems that would affect the quarrying of limestone in the area.	6	<u>Weathering;</u> • Analysis of area where limestones are present and thus sinkholes could be a problem / solution cavities / subsidence • Limestone is prone to Chemical weathering • Increased weathering can cause instability <u>Beds;</u> • Beds should typically be uniform • Impurities within the beds <u>Faulting;</u> • Faulting within the area leading to instability of beds / reactivation of faults • Faulting of the area meaning lateral continuity of the beds is compromised • Faulting can allow water ingress / increasing secondary permeability <u>Folding / dip of beds</u>; • Folded beds potentially make quarrying difficult due to steep dips / instability in steeply dipping beds / problematic for machinery • Instability of quarry walls / steeply dipping beds and dangers during quarrying	2.1a 3.1e

Question			Answer	Mark	Guidance	AO Element
			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.*		<u>Jointing;</u> • Joints can allow water ingress / increasing secondary permeability • Joints can lead to collapse during quarrying / weakening the rock <u>Water;</u> • Level of the water table could lead to flooding of quarries • Limestone is porous and permeable and allows water ingress • Secondary permeability can be increased by chemical weathering <u>Drift deposits;</u> • Presence of overlying alluvial deposits can make quarrying difficult (moving the overburden)	

Question			Answer	Mark	Guidance	AO Element
3	(a)	(i)	Porosity – Volume / percentage of pore space within a rock ✓ Permeability – The rate at which a fluid flows through a rock / concept of interconnected pores allowing movement ✓	2	ALLOW amount of pore space For permeability the concept of a flow of liquid is needed	1.1a
3	(b)	(i)	**Sample B** Explanation to state that <u>porosity</u> in Sample B is higher ✓ This is due to the lack of / no cement around the grains AND so more hydrocarbons can be stored ✓ Explanation to state that <u>permeability</u> in Sample B is higher✓ This is due to the lack of / no cement around the grains AND so more hydrocarbons can be transmitted through the rock ✓	4	ORA	3.1a
3	(b)	(ii)	**First check the answer on the answer line.** **If the answer = 0.001875 $m^3 s^{-1}$ or 1.875 x 10^{-3} $m^3 s^{-1}$ award 3 marks** $Q = 0.00001 \times 1500 \left(\frac{160-110}{400}\right)$ ✓ $m^3 s^{-1}$ ✓	3	**ALLOW** answer given per hour; x 60 for minutes then x 60 for hours = 6.75 m^3/hour **ALLOW** answer given per day; x 24 for hours = 162 m^3/day **ALLOW** for Max 1 mark; correct calculation using $cm^3 s^{-1}$; $Q = 0.001 \times 1500 \left(\frac{160 - 110}{400}\right)$ OR = 0.1875	2.1b

Question			Answer	Mark	Guidance	AO Element
4	(a)	(i)	Shape; rhombic ✓ Cleavage; 3 planes / rhombohedral ✓	2		2.1a
4	(a)	(ii)	Reaction with (dilute) hydrochloric acid ✓ Hardness / Moh's hardness kit ✓	Max 1	**DO NOT ACCEPT** colour or density	2.1b
4	(a)	(iii)	Mass; Use a balance to find and record mass of mineral ✓ Volume; Fill a measuring cylinder/ eureka can to a specified amount with water ✓ Place the mineral into the water and measure the volume of water displaced ✓ Divide mass by volume to give density in g cm^{-3} ✓	Max 2	1 mark MAX should be for determining volume DO NOT ACCEPT mass measured after volume as specimens will be wet giving inaccurate results	1.1b

Question			Answer	Mark	Guidance	AO Element
4	(b)		Accept any **two** points from one type of mineral deposit: <u>Placer deposits;</u> Minerals with high densities are weathered out of mineral veins ✓ Minerals are transported ✓ Minerals are deposited when current velocity drops ✓ Minerals are preferentially deposited in one place (normally with unconsolidated sediment) ✓ As placer deposits Gold / Cassiterite ✓ <u>Magmatic Segregation;</u> Ultramafic OR Mafic magma begins to slowly crystallise / cools at depth in a magma chamber ✓ High density metallic minerals form first / crystals are denser than the magma / high temperature metallic minerals crystalise out first ✓ High density metallic minerals slowly sink to the base of the magma chamber / gravity settling / sink to form cumulate layers / sink to form metal rich layers ✓ Layers of platinum / chromite ✓	Max 2	**ACCEPT** Sites of deposition such as meander bends, plunge pools, upstream of projections, downstream of confluences and beach deposits as example of placer deposits	1.1b

<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Mark</th><th>Guidance</th><th>AO Element</th></tr>
<tr><td>5</td><td>(a)</td><td></td><td><u>Energy levels;</u>
3 or 4 Energy levels correct ✓
5 or 6 energy levels correct ✓✓

<u>Sea levels;</u>
5 or 6 sea levels correct ✓</td><td>3</td><td>MAX 2 marks for energy levels

<table>
<tr><th>Bed</th><th>Thickness (m)</th><th>Rock description</th><th>Features visible</th><th>Energy level (Low, med, high)</th><th>Sea Level (Low, Med High)</th></tr>
<tr><td>1</td><td>1.00</td><td>Well-bedded shale
Pale grey</td><td>Marine brachiopods and Bivalves</td><td>L</td><td>H</td></tr>
<tr><td>2</td><td>1.20</td><td>Siltstone
Laminated
Coarsening upwards from clay to silt</td><td>Contains bivalve shells
Some bioturbation visible</td><td>L</td><td>m</td></tr>
<tr><td>3</td><td>1.70</td><td>Uneven base
Coarsening upwards from fine to medium sandstone</td><td>Small scale Cross - bedding visible throughout bed
Some scattered plant material</td><td>M</td><td>M</td></tr>
<tr><td>4</td><td>0.20</td><td>Silty mudstone
Reddish-brown colour</td><td>Contains plant roots towards the top of the bed</td><td>L</td><td>L</td></tr>
<tr><td>5</td><td>0.10</td><td>Black, shiny</td><td>None</td><td>L</td><td>L</td></tr>
<tr><td>6</td><td>0.75</td><td>Well bedded shale</td><td>Marine Brachiopods, well preserves and intact</td><td>L</td><td>H</td></tr>
<tr><td>7</td><td>1.00</td><td>Laminated siltstones</td><td>Bioturbation and trace fossils (burrows)</td><td>L</td><td>m</td></tr>
</table>
</td><td>1.1b
2.1b
3.1b</td></tr>
</table>

Question			Answer	Mark	Guidance	AO Element
5	(b)		Asymmetrical ripples ✓ Unidirectional flow / current flow indicated on diagram by an arrow from west to east / current described as being from West to east ✓ Recognition of grains carried up the Stoss / shallow slope AND then fall down the Lee / Steep slope ✓ Explain how a compass could be used to measure the bearing of the ripples ✓	2		3.1b
5	(c)		<u>Climate;</u> High rainfall / high temperatures / humid climate ✓ Tropical climate ✓ Equatorial regions ✓ <u>Paleoenvironment;</u> Requires a highly productive ecosystem / rapid plant growth / dense forest ✓ Deposition on land / terrestrial / delta top / swamp / anoxic environment ✓ Plant material accumulates / rapid burial / delta or channel switching causes burial ✓	Max 3	MAX 2 marks from either Climate or Palaeoenvironment section	3.1b

Question			Answer	Mark	Guidance	AO Element
5	(d)		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 a detailed evaluation, linking knowledge and understanding of the different possible causes of sea level change and linking them **to cyclothem deposition/ deltaic environments** *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 an evaluation, linking knowledge and understanding of the possible causes of sea level change and linking them to cyclothem deposition **OR** a detailed evaluation of SL change and tectonic processes *There is a line of reasoning presented with some structure. The information presented is relevant and supported by some evidence.*	6	**Deltas;** Causes of repeated cycles could relate to • isostatic change caused by subsiding deltaic sediments or by tectonics • global eustatic change can lead to changes in deltaic environments • migration of delta channels/ delta switching • changes in rate of sedimentation • Increase in sedimentation allows the delta to build out into the sea • Decrease in sedimentation results in the delta being inundated by the sea **Sea Level changes** • Difference between eustatic and isostatic change • Examples of Eustatic change • Examples of Isostatic change e.g. Scotland / Scandinavia • Resulting in raised beaches / sinking e.g. SE England • Uplift of land masses causing initial SL fall • Uplift resulting in increased amount of weathering, erosion and transport and increased sedimentation in basin and falling SL • Reasons for uplift	resulting in raised beach

Question			Answer	Mark	Guidance	AO Element
			Level 1 (1–2 marks) Gives a basic evaluation, with basic knowledge and understanding of the possible causes of sea level change / tectonics and may attempt to link them to cyclothem deposition. *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.*		• Climate change e.g. thermal expansion of sea water / polar ice caps • Greenhouse and Icehouse conditions • Wilson cycle **<u>Local tectonic variations</u>**; • Faults • Rifting and subsidence • Earthquakes e.g. leading to tsunamis • MOR formation and global SL • submarine volcanic eruptions • Hot spot / mantle plume volcanic activity to form seamounts / guyots **<u>Case Studies;</u>** • Appropriate reference to Welsh basin • Jurassic basin rifting / cyclical deposition	

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