

**GCE**

**Geology**

**H414/03: Practical skills in geology**

Advanced GCE

**Mark Scheme for November 2020**

OCR (Oxford Cambridge and RSA) is a leading UK awarding body, providing a wide range of qualifications to meet the needs of candidates of all ages and abilities. OCR qualifications include AS/A Levels, Diplomas, GCSEs, Cambridge Nationals, Cambridge Technicals, Functional Skills, Key Skills, Entry Level qualifications, NVQs and vocational qualifications in areas such as IT, business, languages, teaching/training, administration and secretarial skills.

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.

© OCR 2020

Annotations available in RM Assessor

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

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

<b>Annotation</b>	<b>Meaning</b>
<b>DO NOT ALLOW</b>	Answers which are not worthy of credit
<b>IGNORE</b>	Statements which are irrelevant
<b>ALLOW</b>	Answers that can be accepted
( )	Words which are not essential to gain credit
—	Underlined words must be present in answer to score a mark
<b>ECF</b>	Error carried forward
<b>AW</b>	Alternative wording
<b>ORA</b>	Or reverse argument

**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	(a)	(i)	Schistosity / Schistose banding ✓ Gneissosity / Gneissose Banding ✓	1	1.1a	<b>ALLOW</b> foliation
1	(a)	(ii)	Gneiss ✓ Schist ✓	1	1.1a	
1	(b)	(i)	A – Four equal sized arrows from top, bottom, left and right / four equal sized arrows in any direction but the arrows should be 90 degrees apart OR no arrows to signify contact metamorphism and no pressure AND B – some attempt to show understanding of principle stress directions ✓	1	2.1b	<b>ALLOW</b> arrows that are different sizes to indicate maximum and minimum on B  <b>ALLOW</b> 2 maximum stress arrows from EITHER top and bottom OR top left and bottom right OR top right and bottom left on B  <b>DO NOT ALLOW</b> 2 maximum stress arrows from the left and right on B  <b>ALLOW</b> less than 4 direction arrows on A if B is correct  <b>ALLOW</b> on B 2 maximum stress arrows if labelled correctly
1	(b)	(ii)	A ✓	1	1.1a	<b>ALLOW</b> B as correct ONLY if the arrows on fig 1.2 show a maximum stress direction for A and no maximum stress direction for B OR no maximum stress directions for A or B
1	(c)		muscovite ✓ parallel ✓ quartz ✓	3	1.1a	

Question		Answer	Mark	AO element	Guidance
2	(a)*	<p>Refer to marking instructions on page 5 of mark scheme for guidance on marking this question.</p> <p><b>Level 3 (5–6 marks)</b> A detailed evaluation and judgement of igneous rock identification including texture, crystal size and mineralogy and how they can be used in the field. Answers may include reference to crystal shape in relation to cooling</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><b>Level 2 (3–4 marks)</b> A detailed discussion of igneous rock identification including texture, crystal size and mineralogy and possibly how they can be used in the field. A full evaluation may not be included and / or not all of the identifying properties discussed.</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><b>Level 1 (1–2 marks)</b> A discussion of igneous rock identification including at least one of texture, crystal size or mineralogy.</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><b>0 marks</b> <i>No response or no response worthy of credit.</i></p>	6	3.1c 2.1b 1.1c	<p><b>AO3.1c: Evaluates geological information, ideas and evidence</b> discusses issues with reference to igneous rocks, for example: silica % cannot be identified in the field / difficult to identify if rocks have been exposed and weathered / fined grained igneous rocks have crystals that are too small to measure / have interlocking crystals</p> <p><b>AO2.1b: Apply knowledge and understanding of geological skills and techniques</b> recognises that some difficulties occur, for example: some minerals may be difficult to identify</p> <p><b>AO1.1c: Demonstrates knowledge and understanding of geological ideas</b> Silicic or felsic / light coloured / leucocratic / quartz / feldspars / micas Intermediate / medium colour / mesocratic / hornblende / amphibole / biotite / feldspars Mafic / dark coloured / melanocratic / augite / pyroxene / feldspars / olivine Ultramafic / olivine / augite / pyroxene Glassy / obsidian Intrusive / plutonic / coarser Extrusive / finer / too small to see / vesicles / amygdaloids Porphyritic / vesicular / amygdaloidal / equigranular OR equicrystalline / ophitic fine grained (&lt;1mm) medium grained (1mm-5mm) coarse grained (&gt;5mm) rocks are crystalline</p>

H414/03

Mark Scheme

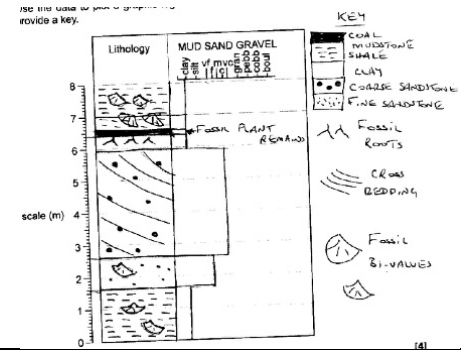
November 2020

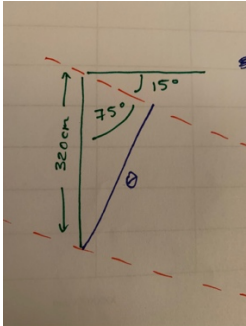
Question			Answer	Mark	AO element	Guidance
						the crystals might be different sizes and shapes / euhedral / Subhedral / anhedral the crystals may be different colours  <b>DO NOT ALLOW</b> answers which explain why the rock is not sedimentary or metamorphic



Question			Answer	Mark	AO element	Guidance
2	(b)	(i)	Porphyritic texture / large pink crystals / phenocrysts surrounded by smaller crystals / feldspar phenocrysts ✓ Groundmass / mixture of black, white and clear crystals / different minerals / 2 named minerals from quartz, mica and feldspar ✓ Subhedral and anhedral crystals ✓	2	3.1a	<b>ALLOW</b> Euhedral <b>ALLOW</b> well-formed and moderately well-formed crystals
2	(b)	(ii)	Accurately measures the crystals 26 +28+24+18+27 mm ✓ Calculate mean crystal size: 25 mm answer should be converted to mm ✓	2	1.1d	<b>ALLOW</b> +/- 2mm  <b>ALLOW</b> +/- 2mm  <b>ALLOW</b> a correct mean calculation in cm if the 5 crystals had been measured in cm as ecf
2	(b)	(iii)	Granite ✓	1	3.1b	
2	(c)	(i)	Dyke ✓	1	1.1b	
	(c)	(ii)	<i>Any three:</i> Baked margin identified in country rock AND chilled margin identified in dyke ✓ Dyke AND country rock identified / (contact) metamorphic rock ✓ Joints within the igneous rock OR within the country rock ✓ Any valid measurement indicated on sketch ✓	3	1.1b	<p>CHILLED MARGIN ALONG EDGES OF THE DYKE</p> <p>DYKE</p> <p>COUNTRY ROCK</p> <p>JOINTS</p> <p>BAKED MARGIN IN COUNTRY ROCK ALONGSIDE EDGE OF THE DYKE</p> <p>WIDTH OF DYKE 50 cm</p>

Question			Answer	Mark	AO element	Guidance
3	(a)	(i)	4270 kg/m <sup>3</sup> ✓✓✓  OR  85.343 / 19.97 = 4.274 ✓ 4.274 x 1000 = 4273.56 ✓	3	2.1b	<b>AWARD</b> 3 marks for correct answer  <b>ALLOW</b> 2 marks max for incorrect sig. figs OR errors in one of the stages
3	(a)	(ii)	samples may contain fractures / porosity which reduces the density ✓ mineral sample may not be pure / different minerals might be present ✓	1	3.1f	<b>DO NOT ALLOW</b> answers referring to human error
3	(a)	(iii)	avoid water spillage <b>AND</b> slip hazard <b>OR</b> water getting into electrical sockets / electrical equipment ✓	1	1.1d	<b>DO NOT ALLOW</b> if not related directly to experiment e.g. do not credit falling over bags / tying back hair / general lab safety
3	(b)	(i)	Mineral A: Galena <b>AND</b> Mineral C: Calcite <b>AND</b> Mineral D: Magnetite ✓	1	3.1b	Need all three for mark
3	(b)	(ii)	Tastes like salt / soluble in water / carry out density test to identify <u>low</u> density ✓	1	1.1c	
3	(c)		Use reference material e.g. fingernail / copper coin / steel nail / glass OR mineral from Moh's hardness kit to scratch surface of unknown mineral ✓ <u>Harder</u> reference material / mineral scratches surface <b>AND</b> <u>softer</u> material / mineral leaves no scratch / a streak on the surface ✓ Quotes accurate hardness values for identified materials / minerals <b>AND</b> unknown mineral ✓ Repeat tests to confirm answer ✓	3	1.1d	<b>ALLOW</b> 1 mark max for a general reference to use of different named hardness items to ascertain hardness

Question		Answer	Mark	AO element	Guidance
4	(a) (i)	<p>Bed thickness plotted correctly ✓</p> <p>Lithology indicated in column two using correct symbols e.g. stipples for sandstone, brickwork for limestone etc ✓</p> <p>Grain sizes plotted correctly ✓</p> <p>Key provided to show features <b>OR</b> log annotated with features (fossils and sedimentary structures) ✓</p>	4	2.1b	<p><b>ALLOW</b> one incorrect plot for thickness <b>OR</b> grain size for maximum marks</p> <p><b>ALLOW</b> a max of 3 marks if the log is drawn 'upside down'</p> 
	(ii)	<p>Identification of a deltaic / delta environment / associated with delta location / meandering river with islands ✓</p> <p>Shallowing up sequence described / progradation of delta / coarsening upward sequence ✓</p> <p>Reference to low energy pro delta/ bottom set beds at the start / end of the sequence referring to fine grained sediment / marine fossils ✓</p> <p>Thinly bedded sandstones indicate an increase in energy / delta front / fore set beds ✓</p> <p>Cross bedded sandstone indicates higher energy water / delta top / channel lag deposit / top set beds / distributary channel / uni- directional current ✓</p> <p>Presence of coal / rootlets / plant remains means land / relative sea level fall / islands / swamps / delta top / top set beds ✓</p> <p>Cyclothem identified and explained / recognises sea level changes / sequence begin again ✓</p> <p>Diachronous boundaries / vertical succession of facies representing sedimentary environments that once existed side by side and migrated over one another / Walther's Law explained ✓</p>	4	3.1e	<p><b>ALLOW</b> a description beginning with the youngest event if the log was inverted in 4ai</p>
Question		Answer	Mark	AO element	Guidance

4	(b)	(i) Direction of water flow determined / cross bedding is preserved on the leeward side / more steeply dipping side of the ripple / cross bedding points in the direction of flow ✓ Compass aligned with flow direction and dial turned to line up red arrows and trend read off at the top ✓	2	3.1b	Mark diagrams as text.
		(ii) $T = 309\text{cm}$ ✓✓✓  Apparent thickness: 320cm Angle of dip ( $\alpha$ ): $15^\circ$ True thickness (T) $\cos \alpha = T/VT$ therefore: $T = VT \times \cos 15$ $T = 320 \times 0.966$ $T = 309.12\text{cm}$ ✓✓✓	3	2.1b	<p>Sin = opposite / hypotenuse  <math>\sin 75 = \theta / 320</math>  <math>\sin 75 \times 320 = \theta</math> true thickness</p> <p><math>\sin 75 \times 320 =</math> true thickness  <math>= 309.09 \text{ cm}</math></p>  <p><b>ALLOW</b> range of 309 - 309.12</p>

Question			Answer	Mark	AO element	Guidance
5	(a)	(i)	Plotting of relevant beds on both sides of the valley ✓ Plotting of beds dip close to horizontal ✓ Extrapolation of Jurassic beds under Cretaceous indicated ✓ Key / correct labelling of rocks present ✓ Accurate location of drift deposits ✓	3	2.1b 3.1c	Dip arrows of 3° and 8° occur close to the line of section. <b>ALLOW</b> a dip on the cross section between 0° - 10° 
5	(a)	(ii)	(Principle of) superposition ✓	1	2.1a	
5	(a)	(iii)	926335 ✓	1	2.1a	<b>ALLOW</b> some margin of error in location of AMG within grid square 9233
5	(b)	(i)	5.67 years ✓	1	2.1a	3 400 000 / 600 000 <b>ALLOW</b> 5.7 OR 5.66 recurring
		(ii)	200,000 tonnes per hectare ✓	1	2.1b	3 400 000 / 17

Question			Answer	Mark	AO element	Guidance
5	(b)	(iii)*	<p>Refer to marking instructions on page 5 of mark scheme for guidance on marking this question.</p> <p><b>Level 3 (5–6 marks)</b> A detailed analysis of the geological issues that may be encountered. A reasoned conclusion based on identification of relevant features from the map and evaluation of risk, linking to detailed application of understanding of the geological hazards is given.</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><b>Level 2 (3–4 marks)</b> An analysis of the geological issues that may be encountered. A conclusion based on identification of relevant features from the map and linking to application of understanding of some geological hazards is given. Achieved if there is no clear conclusion but the geology is detailed and reasoned</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><b>Level 1 (1–2 marks)</b> A discussion of the geological issues that may be encountered. A conclusion may not be provided <b>OR</b> where a conclusion is provided, may not clearly link to relevant features from the map or an understanding of geological hazards.</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>	6	3.1a 3.1c 3.1d	<p><b>AO3.1a Analyse information, ideas and evidence</b> Analyse geological information on map - mainly low lying land near site identified Identification of water as a potential issue in quarrying relating to swelling clays</p> <p><b>AO3.1c Evaluate geological information, ideas and evidence</b> Geological issues include:</p> <ul style="list-style-type: none"> <li>• loss of a finite resource</li> <li>• variable proportions of sand and gravel affecting economic viable</li> <li>• volume of resource</li> <li>• changes to groundwater flow / lowering of the water table</li> <li>• flood risk at the site as low lying / impermeable rock in places</li> <li>• soft unconsolidated material some with high porosity / high permeability</li> <li>• pollution to groundwater</li> <li>• issue of potential instability in quarry sides</li> <li>• potential presence of faults leading to instability issues</li> </ul> <p>Environmental issue;</p> <ul style="list-style-type: none"> <li>• increased traffic on minor roads could lead to road damage / subsidence / load bearing strain on roads</li> </ul> <p><b>AO3.1d Make judgements</b> Gives geological reasons why the quarry should or should not be allowed planning permission, matched with reasoned observations to include reference to location and environmental issues</p>

Question			Answer	Mark	AO element	Guidance
			<b>0 marks</b> <i>No response or no response worthy of credit</i>			
<b>5</b>	<b>c</b>		extreme depth would make mining difficult ✓ possible collapse / subsidence due to relatively weak overlying sedimentary rocks ✓ waterlogging / flooding due to porous sandstones and chalks ✓ possibility of ancient buried faults / faults could be re-activated making mining dangerous ✓ Faults could cause displacement of the coal seam and make extraction more difficult / could allow water into the potential mine ✓	<b>2</b>	<b>3.1e</b>	<b>IGNORE</b> non-geological factors

**OCR (Oxford Cambridge and RSA Examinations)**  
**The Triangle Building**  
**Shaftesbury Road**  
**Cambridge**  
**CB2 8EA**

**OCR Customer Contact Centre**

**Education and Learning**

Telephone: 01223 553998

Facsimile: 01223 552627

Email: [general.qualifications@ocr.org.uk](mailto:general.qualifications@ocr.org.uk)

[www.ocr.org.uk](http://www.ocr.org.uk)

For staff training purposes and as part of our quality assurance programme your call may be recorded or monitored