

Geology

Advanced Subsidiary GCE

Unit **F792**: Rocks – Processes and Products

Mark Scheme for January 2012

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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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Any enquiries about publications should be addressed to:

OCR Publications
PO Box 5050
Annesley
NOTTINGHAM
NG15 0DL

Telephone: 0870 770 6622
Facsimile: 01223 552610
E-mail: publications@ocr.org.uk

Annotations

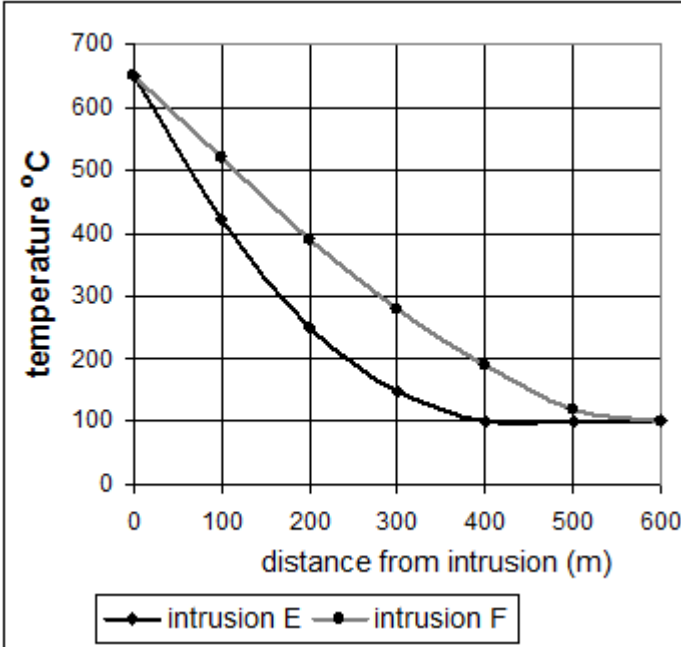
Annotation	Meaning
	Benefit of doubt given
	Incorrect response
	Error carried forward
	Ignore
	Reject
	Benefit of doubt not given
	Omission mark
	Correct response
SEEN	Point has been noted, but no credit has been given (big)

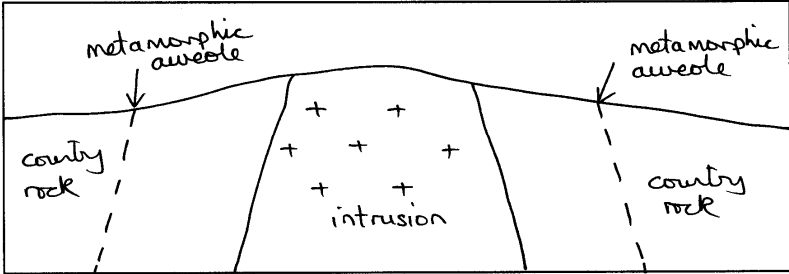
Abbreviations, annotations and conventions used in the detailed Mark Scheme (to include abbreviations and subject-specific conventions).

Annotation	Meaning
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

Question			Answers	Marks	Guidance
1	(a)	(i)	<p>A igneous</p> <p>B diagenesis OR lithification OR compaction OR cementation OR burial</p> <p>C sedimentary</p> <p>D recrystallisation OR metamorphism OR heat AND pressure</p>	<p>1</p> <p>1</p> <p>1</p> <p>1</p>	
		(ii)	where rocks or landmasses are deformed upwards OR folding or thrust faulting pushes rocks up OR compressive forces move rocks up OR fold mountains rise OR the return of buried rocks to the Earth's surface by tectonic forces OR rocks are pushed up by tectonic forces OR rocks are pushed up by seismic activity	1	ACCEPT isostasy DO NOT ALLOW uplifted as alternative to description of upward movement
		(iii)	<p>weathering is the breakdown of rock in situ OR weathering is breakdown of rocks by physical / chemical / biological action</p> <p>erosion is wearing away OR breaking of rock by river OR wind OR ice OR sea OR abrasion OR attrition OR transportation</p>	<p>1</p> <p>1</p>	erosion must have idea of process and method
	(b)	(i)	<p><u>suspension</u> – fine OR clay particles held in the water</p> <p><u>saltation</u> – where sand sized particles OR grains are bounced along the river bed</p> <p><u>traction OR bedload</u> – where larger particles roll OR slide along the river bed</p>	any 2	<p>must have name and description for each mark OR 2 named methods for max 1.</p> <p>description must include concept of size for at least one method</p> <p>DO NOT ALLOW solution</p> <p>DO NOT ALLOW just grains for suspension or traction</p>

Question	Answers	Marks	Guidance
	(ii) abrasion quartz grains are <u>smaller OR finer</u> as they are worn away attrition quartz grains are better <u>rounded</u> OR frosted as corners are knocked off OR grains become rounder in shape as they collide or are worn away grains become smaller in size as they collide or are worn away grains become frosted as they collide or are worn away	1 1	
(c)	igneous olivine sedimentary clay minerals metamorphic garnet	1 1 1	
(d)	chemically stable OR unreactive to weathering OR silica does not weather chemically OR resistant to weathering OR stable at surface temperature and pressure OR at bottom of Bowens reaction series no change when metamorphosed hard OR hardness 7 OR physically resistant has no cleavage survives the rock cycle and all the processes	any 2	
	Total	16	

Question	Answers	Marks	Guidance
2 (a) (i)	1 for set of points for E 1 for set of points for F 1 for curves OR lines drawn in 	1 1 1	ALLOW one point on each curve to be inaccurate lines need to be clear which is E and F for this mark
	(ii) E 246 m F 387 m	1 1	+/- 7 m ecf from graph

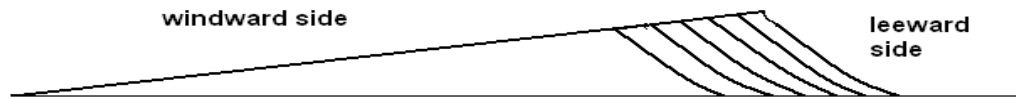
Question	Answers	Marks	Guidance
	(iii) F is the larger intrusion F takes longer to cool down as more magma OR remains hotter for longer rocks stay at same temperature for more time around larger intrusion higher temperatures give larger aureole OR more rock heated up OR heat travels greater distance	1 any 1	
(b)	(i) intrusion country rock metamorphic aureole 	1 1 1	Labels must be in correct relationship to each other but could be shown on just one side of an intrusion. ACCEPT metamorphic aureole as shown on outer edge OR labelled as whole zone. ALLOW plan view if all labels correct for max 2 and max 1 if one label is incorrect.
	(ii) quartzite OR metaquartzite	1	DO NOT ALLOW quartz
(c)	vesicular texture has holes OR vesicles OR vesicular texture formed by trapped gas amygdaloidal has the holes infilled by a mineral eg calcite OR crystals growing inwards OR forming amygdale OR mineral deposited in vesicle	1 1	
(d)	xenolith country rock that falls into magma OR by stopping OR partly assimilated or metamorphosed	1 1	

Question		Answers	Marks	Guidance
	(e)	(i)	granite porphyritic	1 1 ACCEPT granodiorite
		(ii)	large crystals OR phenocrysts of K feldspar formed first and cooled slowly OR phenocrysts cooled at depth groundmass OR smaller crystals formed later OR groundmass formed more quickly OR groundmass formed at shallower depth	1 1 ALLOW one mark for 2 stages of cooling ALLOW 1 mark for ecf on (e)(i) texture if equigranular coarse hence slow cooling at depth OR all crystals cooled at the same rate DO NOT ALLOW groundmass formed at the surface
			Total	19

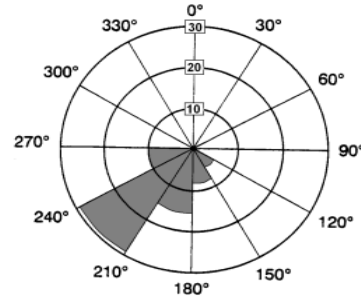
Question			Answers	Marks	Guidance
3	(a)	(i)	any 2 points from shallow sea no sediment OR no clasts OR no clay or sand OR clear warm seas OR tropical conditions high energy OR wave action OR strong currents	1	must have two points for 1 mark
		(ii)	G reef OR bioclastic OR shelly OR fossiliferous H oolite	1 1	
		(iii)	nucleus of grain OR shell fragment OR clastic particle concentric layers of calcium carbonate ooliths are cemented together by calcite precipitated from sea water by evaporation rolling around on the sea floor OR rolling due to strong currents OR rolling due to tides OR rolling due to wave action	any 1 any 1	diagram to show the concentric structure of an oolith must have an explanation
	(b)	(i)	abyssal plain – in flat deep area anywhere near L to right of break of slope continental shelf – in flat area between J and K or to top of slope continental slope – on steeper area between K and L	2	3 correct for 2 1 or 2 correct for 1 mark can be shown as a point or an area
		(ii)	grain size medium OR fine sand 0.5 – 1 mm grain sorting moderate OR poorly sorted grain shape rounded OR well rounded	2	3 correct for 2 1 or 2 correct for 1 mark ALLOW arenaceous for grain size and spherical for shape
		(iii)	shale OR mudstone OR clay OR siltstone	1	

Question		Answers	Marks	Guidance
	(iv)	formed from microfossils OR plankton OR pelagic organisms they die and sink to the sea floor foraminifera OR coccoliths form calcareous ooze siliceous ooze forms below CCD radiolaria form siliceous ooze	any 2	ALLOW suitable named microfossil such as foraminifera
(c)	(i)	finer grains at the top as they are lightest OR take longest to settle out larger, heavier particles at the bottom as they settle out first	1 1	OR 1 mark for description of grains by size and 1 for explanation of particles due to weight OR mass mark annotated diagram as text
	(ii)	flute casts exactly at the base of the sandstone unit greywacke anywhere in sandstone units shale in mud units	2	3 correct = 2 1 or 2 correct = 1 labels must be clearly in the correct place within 1mm of layer or boundary
	(iii)	2 beds of greywacke OR two graded beds	1	mark is for reason
Total			17	

Question			Answers	Marks	Guidance												
4	(a)	(i)	<table border="1"> <thead> <tr> <th>desert feature</th> <th>number from diagram</th> </tr> </thead> <tbody> <tr> <td>alluvial fan</td> <td>6</td> </tr> <tr> <td>barchan sand dune</td> <td>1</td> </tr> <tr> <td>debris flow</td> <td>4</td> </tr> <tr> <td>playa lake</td> <td>3</td> </tr> <tr> <td>wadi channel</td> <td>2</td> </tr> </tbody> </table>	desert feature	number from diagram	alluvial fan	6	barchan sand dune	1	debris flow	4	playa lake	3	wadi channel	2	4	5 or 4 correct = 4 3 correct = 3 2 correct = 2 1 correct = 1
		desert feature	number from diagram														
alluvial fan	6																
barchan sand dune	1																
debris flow	4																
playa lake	3																
wadi channel	2																
		(ii)	from left to right OR west to east	1													
	(b)		coarse grains >2 mm well rounded OR rounded red iron oxide cement OR fine grained matrix common OR red colour due to iron oxide poorly sorted fragments of different composition	any 3	1 mark minimum must be for diagram 1 mark minimum for description Labelling is not essential on the diagram												
	(c)	(i)	external shape of dune steeper on leeward side but < 37 degrees internal stratification drawn parallel to leeward side leeward labelled on steeper side windward labelled on shallow side	1 1 1	Accept a steeper angle drawn if it is clearly labelled at an angle of less than 37 degrees												



Question	Answers	Marks	Guidance
(ii)	<p>correct rose completed to a suitable scale</p> <p>wind direction from north east to south west OR from 30° – 60° to 210° – 240°</p>	<p>1</p> <p>1</p>	<p>Must have all 5 sectors completed</p> <p>Ignore opposite side if completed</p> <p>Scale does not have to be labelled but must fit in area of diagram</p>
Total		13	



Question			Answers	Marks	Guidance
5	(a)	(i)		2	3 correct = 2 1 or 2 correct = 1
		(ii)	gneiss Q granite R hornfels N schist P shale M	max 4	5 or 4 correct 4 marks 3 correct 3 marks 2 correct 2 marks 1 correct 1 marks
		(iii)	both pressure and temperature increase with depth	1	
	(b)		must show interlocking mosaic of crystals with no foliation granoblastic labelled calcite crystals labelled	1 1	scale not needed no round grains

Question			Answers	Marks	Guidance
	(c)	(i)	schist	1	
			schistose OR schistosity OR porphyroblastic	1	
		(ii)	S garnet T quartz U muscovite	2	3 correct = 2 1 or 2 correct = 1
	(d)		large OR coarse crystals OR >5 mm minerals segregate into dark bands and light bands dark bands of biotite OR mafic minerals and light bands of feldspar and quartz movement of fluids greater at high temps so coarse size bands deformed due to high pressure crystals orientated at 90 degrees to pressure	any 2	
			Total	15	

Question	Answers	Marks	Guidance
6	<p>delta top topsets rock - coal OR peat made from plant remains rock - seat earth contains roots of plants OR fine sand or silt – rock - sandstones or gravels OR cross bedded sandstones rocks – clays formed in swamps</p> <p>environment – coal / peat formed in swamp areas OR anaerobic OR between distributaries OR between channels OR in low energy areas environment - seat earth is ancient soil in which trees grew environment – formed in high energy distributaries OR channels environment – clays formed in interdistributary areas OR flood plain deposits</p>	1 1 1 1 1 1 1 max 6	Must include minimum of 1 mark for rock / description and 1 mark for environment / explanation
	<p>delta slope foresets rock - sandstones deposited rock – composition is quartz rich OR can have mica rock - sandstone is well rounded and well sorted rock - show cross bedding</p> <p>environment cross bedding formed due to deposition on delta slope environment – may contains marine fossils OR bivalves as deposited in sea environment – energy decreases with distance off shore</p>	1 1 1 1 1 1 max 3	Must include minimum of 1 mark for rock / description and 1 mark for environment / explanation
	<p>offshore bottomsets rocks - clay OR mudstone OR shale OR limestone deposited rocks - beds can be laminated rocks – can contain marine fossils OR bivalves OR ammonoids OR goniatites</p> <p>environment - fine grained material carried in suspension environment - low energy off shore</p>	1 1 1 1 1 max 3	Must include minimum of 1 mark for rock / description and 1 mark for environment / explanation
	<p>cyclothem sequence drawn to link all 3 deposits map to show relative positions of finer material off shore OR topsets to bottomsets diagram to show cross section across delta</p>	1 1 1 max 3	These diagrams could be in any section. Mark diagrams as text.
	Total	10	

Question	Answers	Marks	Guidance
7	<p>crystal grain size coarse grained - >5mm OR cooled very slowly OR at depth OR <u>plutonic</u> OR batholith OR eg granite medium grained - 1–5mm OR cooled slowly OR <u>hypabyssal</u> OR at intermediate depths OR sills OR dykes OR eg dolerite fine grained <1mm OR fast cooled OR at surface OR volcanic OR extrusive – eg basalt glassy - no crystals OR cooled very fast OR cooled in water OR eg obsidian</p> <p>general statement linking grain size with cooling rate max 1 if not used for each crystal grain size</p>	<p>1 1 1 1 1 max 4</p>	<p>Any correct rock example for each grain size</p> <p>ALLOW general statement igneous rocks are divided into grain sizes coarse, medium, fine (and glassy) if no sizes given</p>
	<p>mineral composition silicic essential minerals quartz and potash feldspar OR quartz and Na rich plagioclase OR quartz, feldspar and mica (muscovite, biotite) intermediate essential minerals any 3 of potash feldspar, plagioclase, quartz, hornblende, biotite mafic essential minerals Ca rich plagioclase and pyroxene (augite) and/or olivine ultramafic = pyroxene OR olivine OR Ca rich plagioclase quartz decreases from silicic to mafic OR ferromagnesian minerals increase silicic to mafic</p> <p>OR Na rich plagioclase only in silicic and/or intermediate Ca rich plagioclase only in mafic and/or ultramafic potash feldspar only found in silicic and/or intermediate rocks quartz only found in silicic and/or intermediate rocks olivine only found in only in mafic and/or ultramafic augite only found in mafic and/or ultramafic</p>	<p>1 1 1 1 1 1 1 1 1 1 max 4</p>	<p>ALLOW general statement leucocratic OR light coloured and melanocratic OR dark coloured (only given once either here or in next section)</p>
	<p>silica percentage – silicic = >66% SiO₂ +OR– 1% – intermediate = 52–66% SiO₂ +OR– 1% – mafic = 45–52% SiO₂ +OR– 1% – ultramafic <45% SiO₂ – +OR– 1%</p>	<p>1 1 1 1 max 3</p>	<p>ALLOW general statement leucocratic OR light coloured and melanocratic OR dark coloured (only given once either here or in previous section) if all 4 groups given with no % max 1</p>
	Total	10	If only a table max 5 marks

OCR (Oxford Cambridge and RSA Examinations)
1 Hills Road
Cambridge
CB1 2EU

OCR Customer Contact Centre

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