OCR
RECOGNISING ACHIEVEMENT

GCE

Geology

Advanced Subsidiary GCE

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

Mark Scheme for January 2013

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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.

OCR will not enter into any discussion or correspondence in connection with this mark scheme.

Annotations

Annotation	Meaning
	Unclear
	Benefit of doubt
	Contradiction
	Cross
	Error carried forward
	Ignore
	Benefit of doubt not given
	Poor diagram
	Reject
	noted but no credit given
	Tick
	Omission mark
	Maximum (marks available for) Response

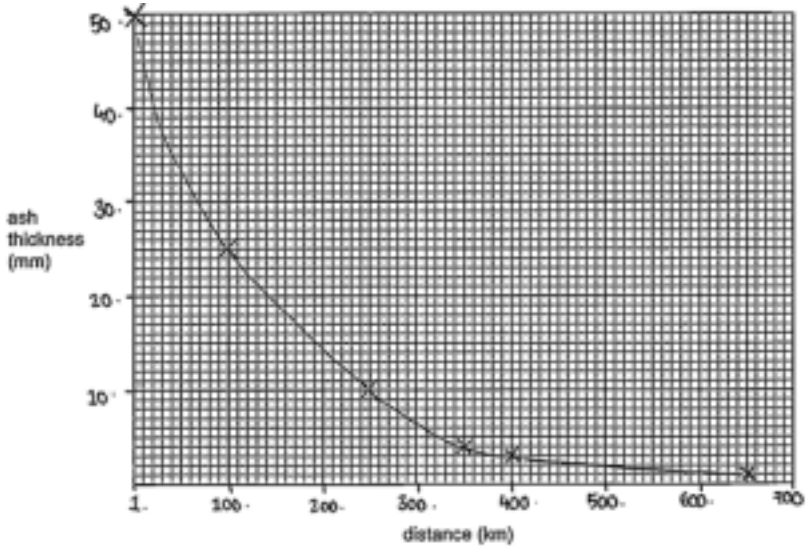
Annotation	Meaning
DO NOT ALLOW	Answers which are not worthy of credit
IGNORE	Statements which are irrelevant
ALLOW	Answers that can be accepted
( )	Words which are not essential to gain credit
__	Underlined words must be present in answer to score a mark
ECF	Error carried forward
AW	Alternative wording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

Question			Answer	Marks	Guidance
1	(a)		**rock** made of grains **OR** crystals **OR** minerals; sediment that has hardened **OR** magma that has cooled; an aggregate of minerals; a mixture of minerals; naturally occurring substance composed of mineral/s **mineral** a naturally occurring inorganic / crystalline substance; a solid with a definite or fixed <u>chemical composition</u>; a solid with an ordered atomic structure; an inorganic crystalline compound **OR** element**;** **AW**	1 1	Any 1 point Any 1 point
	(b)	(i)	sand dunes **OR** barchans	1	**ALLOW** dunes
		(ii)	cross bedding **OR** ripple marks	1	
		(iii)	<u>any **one** from</u> inside of meander bend on river; point bar; area of low energy where deposition occurs **OR** area of low energy shallow water;	1	**ALLOW** description of slip off slope in meander
		(iv)	1 - C 2 - B 3 - A	2	3 correct = 2 1 or 2 correct = 1
	(c)		compaction / diagenesis pushes grains together **OR** compaction / diagenesis reduces pore space **OR** grains fused / compacted together by load pressure **OR** grains fused / compacted together by weight of overlying sediments; cement fills pores between grains to make solid **OR** chemical cement glues grains together **OR** matrix infills gaps between grains to make solid	2	1 mark for compaction and 1 mark for cement if description is too limited but compaction and cement or matrix stated **ALLOW** 1 mark **ALLOW** named mineral for cement

Question			Answer	Marks	Guidance
	(d)		**drawing:** grains drawn as round or subrounded **scale:** scale that shows grains over 2mm to a maximum of 100cm	1 1	at least 2 grains need to be drawn
	(e)		**name:** saltation for sandstone and traction for conglomerate; grains moved by saltation where grains bounce / skip above river bed; pebbles moved by traction **OR** bed load by sliding / dragging / rolling on river bed;	3	**ALLOW** drawings to show grains bouncing or sliding if labelled 1 mark for 2 named methods and 1 mark for each description **OR** If only one correct method is given for a rock but method has a more detailed description such as actual grain sizes / energy levels / height of bounce max 2 marks **ALLOW** saltation for conglomerate
			Total	**14**	

Question			Answer	Marks	Guidance
2	(a)	(i)	a mineral that is stable over a particular temperature and pressure range **OR** a mineral that is formed under specific temperature and pressure conditions **OR** a mineral that indicates particular temperature and pressure conditions	1	**ALLOW** found in a metamorphic zone or grade **OR** used to determine the degree of metamorphism
		(ii)	left side of garnet **OR** right side of chlorite for lower limit and left side of sillimanite for upper limit	1	both sides must be drawn for the mark
		(iii)	regional	1	
		(iv)	low slate medium schist high gneiss	3	1 mark for each correct rock
		(v)	shale **OR** mudstone **OR** clay	1	
	(b)		**similarity** both have same composition **OR** both are made of Al_2SiO_5 **OR** both are polymorphs so have different forms **OR** both are found in schist **OR** both are found in gneiss **OR** both are index minerals for <u>regional</u> metamorphism **difference** sillimanite forms at high T/P while kyanite forms at medium T/P **OR** sillimanite forms at higher T/P than kyanite **OR** sillimanite forms at higher T than kyanite **OR** kyanite not found in contact metamorphic rocks due to low P sillimanite is found	1 1	**ALLOW** correct reference to crystal shapes with kyanite triclinic and sillimanite orthorhombic or colours with kyanite mainly blue and sillimanite white/brown/green. both minerals need to be included to show difference
	(c)	(i)	garnet is large crystal in E labelled porphyroblast	1	
		(ii)	D <u>gneissose</u> banding E schistosity **OR** schistose foliation **OR** <u>porphyroblastic</u>	2	1 mark for each correct texture **DO NOT ALLOW** porphyroblast

Question			Answer	Marks	Guidance
	(d)	(i)	garnet will scratch glass **OR** garnet cannot be scratched by steel; muscovite will be scratched by a copper coin but not a fingernail **OR** copper coin will scratch muscovite but not garnet	2	**ALLOW** 1 mark for a general correct statement of hardness testing for the minerals without the mineral names **ALLOW** muscovite can just be scratched by fingernail
		(ii)	no cleavage means it will fracture **OR** will break unevenly **OR** has no planes of weakness **OR** will not split or flake perfect cleavage will split easily into thin layers **OR** has planes of cleavage parallel to each other	2	**ALLOW** 1 mark for a general correct statement of cleavage for the minerals without the mineral names **OR** muscovite will split while garnet will not
			Total	**16**	

Question			Answer	Marks	Guidance
3	(a)	(i)		2	1 mark for correct axes and line or curve on graph 1 mark for accurate points
		(ii)	**description** ash is thickest close to the volcano and rapidly thins **explanation** the ash particles are dense so settle out close to the volcano **OR** the initial energy from the eruption diminishes with distance **OR** velocity of ash cloud decreases	1 1	
		(iii)	75km +/-5km	1	ecf
		(iv)	lahars	1	
	(b)	(i)	composite **OR** strato-volcano **OR** intermediate	1	**ALLOW** just strato

Question			Answer	Marks	Guidance
		(ii)	steep sided volcano drawn with sides between 30 and 60 degrees crater at the top as a hollow feeder vent rising from depth or magma chamber to crater / parasitic cone alternating layers of lava and ash parallel to the sides of the volcano	4	each point must be drawn and correctly labelled
	(c)		any **two** from construction of hazard maps; extent of ash deposits; extent **OR** path of past lava flows; extent of blast damage; extent **OR** path of past lahars; extent **OR** path of past pyroclastic flows; study of geological history **OR** old deposits of ash / pyroclasts for thickness **OR** composition **OR** frequency and intensity; pattern of valleys as hazards of pyroclastic flows **OR** nuée ardentes **OR** lava flows **OR** lahars follow them;	2	**ALLOW** use of either pyroclast term of *ash* or rock term of *tuff*
			Total	**13**	

Question			Answer	Marks	Guidance
4	(a)	(i)	1 H 2 J 3 F 4 G	3	4 correct = 3 2 or 3 correct = 2 1 correct = 1
		(ii)	limestone marble; sandstone metaquartzite; shale spotted rock **OR** andalusite rock **OR** hornfels;	3	1 mark for each correct rock **ALLOW** quartzite **DO NOT ALLOW** orthoquartzite **ALLOW** slate for rock
		(iii)	andalusite	1	**ALLOW** cordierite
	(b)		oceanic and continental crust / plates drawn and labelled; subduction of oceanic plate below continent; partial melting of oceanic crust and rising magma; rising magma melts continental crust to form granite batholith	4	**MAX** 3 if no description **MAX** 3 if no diagram
	(c)	(i)	area at each side of the layered intrusion in the chilled margin	1	Must be shaded just inside the intrusion on at least one side. Area shaded must be less than 5mm wide
		(ii)	cumulate	1	**ALLOW** if correct answer given in part (iii)
		(iii)	Any **two** from denser mafic minerals **OR** pyroxene **OR** olivine sink faster; high temperature minerals **OR** high melting point minerals crystallise and sink; plagioclase has lower density so sinks more slowly; the layers are formed by gravity settling; convection currents in the magma cause layering;	2	**ALLOW** if correct answer given in part (ii)

Question			Answer	Marks	Guidance
		(iv)	any **two** from silicic minerals form last on Bowens Reaction Series **OR** form at low temperature; quartz, K feldspar, muscovite are late stage products of differentiation **OR** Na rich plagioclase forms late; all mafic minerals already used in forming the layers **OR** magma is depleted in iron/magnesium; formation of mafic minerals uses less silica so more silica is left **OR** magma is enriched in silica; filter pressing causes lighter, silicic to accumulate at the top;	2	**DO NOT ALLOW** silicic minerals rise up
			Total	**17**	

Question			Answer	Marks	Guidance
5	(a)	(i)	K 8 weathering L 6 erosion M 7 transport N 5 deposition	3	4 correct = 3 2 or 3 correct = 2 1 correct = 1
	(b)	(i)	rock flour and / or clay and boulders carried in ice **OR** material of all sizes carried in ice **OR** frost shattered rocks fall on to ice **OR** rocks plucked from base and carried in ice; ice melts and load deposited **OR** deposition in a moraine in front of ice **OR** deposition as the ice retreats **OR** deposition from ice and not transported by water;	2	1 mark for the material transported and 1 for deposited
		(ii)	silt layer formed in spring or summer **OR** silt layer forms from snow melt; clay layer forms in autumn or winter as thin layer **OR** clay layer forms rich in organic material or rich in algal bloom;	2	**ALLOW** 1 mark for general idea of two layers per year **OR** variations in seasonal deposition **ALLOW** 1 mark for deposition of fine sediment
		(iii)	rivers from meltwater from the ice carried sand and gravel **OR** sands and gravels transported by ice and then rivers **OR** sediments transported in meltwater rivers and deposited.	1	
	(c)		pebbles aligned by the current with long axis parallel; pebbles come to rest with a clear long axis leaning down current **OR** dipping up current;	2	arrow for current is essential on the diagram OR description of correct current direction 1 mark for diagram and 1 mark for description

Question			Answer	Marks	Guidance
	(d)	(i)	<u>any **three** from</u> saline water enters from open sea **OR** bar restricts entry of water from the sea **OR** shallow water increases the rate of evaporation **OR** saline water cannot flow out into sea; evaporation causes the water in the basin to become more saline **OR** supersaturated **OR** hypersaline (due to water level reducing); salts are precipitated / crystallise out from saturated solution; dense salts are deposited on basin floor **OR** minerals crystallise out with least soluble first; cycles of evaporite deposits may form	3	labels on the diagram can be credited as text
		(ii)	last K salts / polyhalite / correct K salts halite anhydrite or gypsum first calcite **OR** carbonates	3	4 correct = 3 2 or 3 correct = 2 1 correct = 1 max 1 for inverted sequence of 3+ minerals or 2 correct minerals written in wrong place **ALLOW** anhydrite and gypsum if calcite omitted
	(e)	(i)	<u>cubic</u> salt **OR** halite crystals form; halite <u>dissolved</u> leaving cubic hole; holes <u>infilled</u> by (fine) sediment or silt	3	can be shown as a series of labelled diagrams mark diagrams as text 2 max if no diagrams
		(ii)	desiccation cracks **OR** mud cracks **OR** ripples	1	
			Total	**20**	

Question			Answer	Marks	Guidance
6			**porphyritic** • large crystals are called <u>phenocrysts</u> and they formed first; • large crystals / phenocrysts form at great depth **OR** >10 km **OR** in batholith **OR** in intrusion **OR** in the magma chamber below the volcano; • large crystals / phenocrysts, (usually K feldspar) forms by cooling slowly • finer grained <u>groundmass</u> forms later; • finer crystals / groundmass cooled more quickly **OR** by rapid cooling; • magma and crystals move up within the crust (by diapiric action) **OR** magma and crystals are erupted to the surface when an eruption occurs; • labelled diagram showing two sizes of crystals in a correct named rock matched to description e.g. granite or porphyritic basalt;		max 5 for porphyritic texture
			flow banding • bands of dark / mafic / biotite and light / silicic / quartz with feldspars; • bands are often contorted **OR** folded - due to silicic magma **OR** viscous lava **OR** because the lava is thick /sticky; • the colour bands form due to the separation of minerals in a lava flow; • the mineral are aligned roughly parallel to the flow direction; • labelled diagrams showing layers in a correct named rock such as rhyolite;		max 4 for flow banding texture
			amygdaloidal • where vesicles formed in a rock due to trapped gas bubbles leaving holes; • vesicles are infilled by minerals deposited from ground water; • common minerals are calcite **OR** quartz crystals; • crystals grow in towards the centre of the hole; • large amygdales partially filled with crystals are called geodes; • labelled diagram to show amygdales in a correct named rock;		max 4 for amygdaloidal texture **ALLOW** any correct minerals **DO NOT ALLOW** pumice as example of amygdaloidal rock amygdales must have crystals drawn in them max 8 if no diagrams max 8 if no rock names
			Total	**10**	

Question			Answer	Marks	Guidance
7			**chemical** • **oolitic limestone** is formed by chemical process; • spherical grains of aragonite or calcite or calcium carbonate; • nucleus of shell fragment or sand grains; • rolled along shallow sea floor or sand bank under high energy conditions / wave action; • evaporation causes precipitation of calcium carbonate from sea water; • calcium carbonate (aragonite) deposited around nucleus/ concentric layers and in cement; • **micritic limestone** or micrite is formed by chemical process; • fine grained lime rich mud • formed in low energy conditions in lagoon; • evaporation of sea water and precipitation of calcium carbonate;		max 5 for chemical processes labelled diagram can be marked as text **ALLOW** micrite as a biological limestone if the explanation is that it formed from animal faeces
			• ooliths **OR** fossils cemented by calcite (in form of sparite);		
			biological • **fossiliferous limestone OR** bioclastic **OR** shelly **OR** reef **OR** crinoidal is formed by biological processes; • made of broken shell fragments • made of correct named fossils including coral; • reefs form unbedded / massive limestones due to upward growth • if fossils are whole formed in lower energy environment; • if fossils are broken formed in moderate or high energy conditions **OR** on reef slope; • **chalk** is formed by biological processes; • skeletal remains of microfossils **OR** coccoliths; • calcareous algae, which breaks down when algae die; • formed in low energy conditions		max 5 for biological processes **ALLOW** specific fossil parts eg ossicles/stem of crinoid mark diagrams as text
			Total	**10**	

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