

**GCE**

**Geology**

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

Advanced Subsidiary GCE

**Mark Scheme for June 2016**

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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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## 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 response

<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

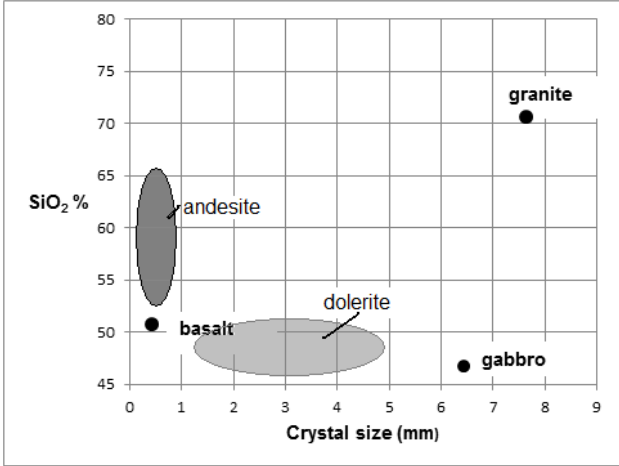
Question			Answer	Marks	Guidance
1	(a)	(i)	<p><b>ANY</b> one from:</p> <ul style="list-style-type: none"> <li>• rocks made from fragments / grains / sediment ;</li> <li>• rocks made of clasts of pre-existing rocks ;</li> <li>• rocks made from the products of weathering and erosion ;</li> <li>• rocks that are mechanically / physically formed and contain fragments / clasts ;</li> <li>• broken and fragmental ;</li> </ul>	1	<b>IGNORE</b> fossils
		(ii)	<p>biological <b>OR</b> fossiliferous <b>OR</b> rocks formed from plant / fossil / shell material  <b>AND</b>  chemical <b>OR</b> rocks formed by precipitation of salts from water <b>OR</b> evaporites ;</p>	1	both correct for 1 mark
	(b)	(i)	<p><b>A</b> breccia ;  <b>B</b> conglomerate ;  <b>C</b> arkose ;  <b>D</b> greywacke ;</p>	1 1 1 1	
		(ii)	<p>2 to 0.0625 mm <b>OR</b> 2 to 0.063 mm  <b>OR</b> 2 to 1/16 mm <b>OR</b> 2 to 1/256 mm <b>OR</b> -1 to 4 <math>\phi</math> ;</p>	1	
		(iii)	clay minerals ;	1	<b>ALLOW</b> any correctly named clay mineral such as montmorillonite / kaolinite / illite
		(iv)	<p>angular grains – sharp pointed corners  <b>AND</b>  rounded grains – roughly spherical or oblate shape with no corners ;</p>	1	<p>both correct for 1 mark  <b>MUST</b> have at least one correct label  <b>IGNORE</b> scale</p>

Question		Answer	Marks	Guidance
	(c) (i)	<p><b>ANY</b> 3 from:</p> <p><u>well</u> rounded <b>OR</b> high sphericity grains ;</p> <p>grains about 1 / 0.5 mm size <b>OR</b> medium <u>sand</u> sized grains <b>OR</b> grains 1 / 0 <math>\emptyset</math> size ;</p> <p><u>well</u> sorted <b>OR</b> millet seed sand <b>OR</b> <u>texturally</u> mature ;</p> <p>frosted grains ;</p> <p>grains composed of (all / 100%) quartz / <u>compositionally</u> mature ;</p> <p>coating of (red) Fe<sub>2</sub>O<sub>3</sub> / iron oxide / haematite <b>OR</b> cement of Fe<sub>2</sub>O<sub>3</sub> / iron oxide / haematite ;</p> <p><u>large scale / dune / aeolian / metre scale</u> cross bedding <b>OR</b> <u>asymmetrical</u> ripple marks ;</p>	2	<p>3 correct = 2 marks</p> <p><b>ANY</b> 1 or 2 correct = 1 mark</p>
	(ii)	<p><b>ANY</b> 3 from:</p> <p><u>sub</u> rounded <b>OR</b> <u>sub</u> angular grains ;</p> <p>grains varied in size <b>OR</b> poorly sorted <b>OR</b> moderately sorted <b>OR</b> <u>texturally</u> immature ;</p> <p>grains composed of <b>ANY</b> 2 from: quartz / mica / feldspar / lithic fragments <b>OR</b> <u>compositionally</u> immature ;</p> <p>cement / matrix is varied in composition ;</p> <p>cross bedding <b>OR</b> graded bedding <b>OR</b> <u>asymmetrical</u> ripple marks ;</p>	2	<p>3 correct = 2 marks</p> <p><b>ANY</b> 1 or 2 correct = 1 mark</p> <p><b>DO NOT ALLOW</b> rounded</p> <p><b>ALLOW</b> any correct named mineral / material for cement / matrix</p>
	(d)	<p>bioclastic (limestone) ;</p> <p>calcite ;</p> <p>coccoliths <b>OR</b> calcite ;</p> <p>oolite / oolitic (limestone) ;</p> <p>concentric ;</p> <p>nucleus <b>OR</b> quartz nucleus ;</p>	4	<p>6 correct = 4 marks</p> <p>5 correct = 3 marks</p> <p>3 or 4 correct = 2 marks</p> <p>1 or 2 correct = 1 mark</p>
<b>Total</b>			<b>17</b>	



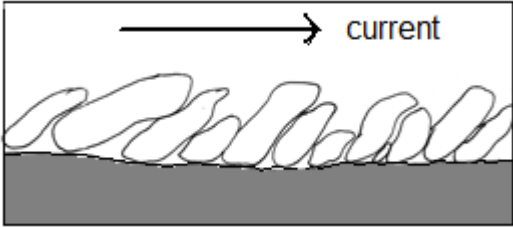




Question			Answer	Marks	Guidance
3	(a)	(i)		2	<p>points can be labelled anywhere in the marked areas</p> <p>andesite &lt;1 mm <b>AND</b> 52 – 66 % silica</p> <p>dolerite 1 – 5 mm <b>AND</b> 45 – 52 % silica</p> <p><b>MAX 1</b> if both points plotted correctly but not labelled</p>
		(ii)	<p><b>gabbro</b> – Ca (rich) plagioclase / Ca (rich) feldspar <b>AND</b> augite / pyroxene ;</p> <p><b>granite</b> – composed of <b>ANY 2</b> from: K feldspar / orthoclase <b>OR</b> Na (rich) plagioclase / Na (rich) feldspar <b>OR</b> quartz ;</p>	1 1	<p>gabbro answers may or may not include olivine / hornblende</p> <p>granite answers may or may not include mica / biotite / muscovite / hornblende</p> <p><b>MUST</b> state correct type of feldspar</p> <p><b>MAX 1</b> if one correct mineral for gabbro <b>AND</b> one correct mineral for granite</p> <p><b>DO NOT ALLOW</b> any minerals that are not used in broad classification</p>

Question		Answer	Marks	Guidance																					
	(iii)	<p><b>gabbro</b> – mafic / ferromagnesian / Fe and Mg rich <u>minerals</u> make gabbro dark in colour / melanocratic <b>OR</b> (minerals such as) augite / pyroxene / olivine are dark coloured making gabbro dark in colour ;</p> <p><b>granite</b> – felsic <u>minerals</u> / silicic <u>minerals</u> make granite light in colour / leucocratic <b>OR</b> (minerals such as) quartz / feldspar are light coloured making granite light in colour ;</p>	1  1	<p><b>MUST</b> relate <u>mineral</u> content to colour <b>IGNORE</b> felsic minerals</p> <p><b>IGNORE</b> mafic minerals</p>																					
	(iv)	silica composition is determined by chemical analysis <b>OR</b> silica composition is determined in a laboratory <b>OR</b> silica composition is determined on crushed rock samples <b>OR</b> test for silica cannot be carried out in the field <b>OR</b> special equipment is required to determine silica content ;	1	<b>ALLOW AW</b> <b>MUST</b> include concept that laboratory test is required																					
(b)		<table border="1"> <thead> <tr> <th>Feature seen</th> <th>lava flow</th> <th>sill</th> </tr> </thead> <tbody> <tr> <td>forms a concordant feature</td> <td>✓</td> <td>✓</td> </tr> <tr> <td>crystal size is 1 to 5 mm</td> <td></td> <td>✓</td> </tr> <tr> <td>crystallisation has taken place more than 1 km below the surface</td> <td></td> <td>✓</td> </tr> <tr> <td>has two baked margins</td> <td></td> <td>✓</td> </tr> <tr> <td>may have a weathered surface</td> <td>✓</td> <td></td> </tr> <tr> <td>the rate of cooling is measured in days or weeks</td> <td>✓</td> <td></td> </tr> </tbody> </table>	Feature seen	lava flow	sill	forms a concordant feature	✓	✓	crystal size is 1 to 5 mm		✓	crystallisation has taken place more than 1 km below the surface		✓	has two baked margins		✓	may have a weathered surface	✓		the rate of cooling is measured in days or weeks	✓		4	5 correct = 4 marks 4 correct = 3 marks 3 correct = 2 marks 1 or 2 correct = 1 mark
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(c)	(i)	<p><b>diagram</b> – round / oval holes labelled as vesicles ;</p> <p><b>scale</b> – 0.5 to 25 mm size for vesicles ;</p>	1  1																						

Question		Answer	Marks	Guidance
	(ii)	phenocrysts / coarser / larger crystals form first so have longer to form <b>OR</b> phenocrysts / coarser / larger crystals form at depth so cool slowly ;  groundmass of coarse / finer crystals forms last so have shorter time to form <b>OR</b> groundmass of coarse / finer crystals form at shallower depths / closer to surface so cool more rapidly ;	1  1	<b>MAX 1</b> mark for general statement of 2 stages of cooling <b>OR</b> 2 depths below the surface  <b>DO NOT ALLOW</b> fine crystal size for groundmass <b>OR</b> groundmass formed by rapid cooling <b>OR</b> groundmass forms by cooling on Earth's surface
<b>Total</b>			<b>15</b>	

Question			Answer	Marks	Guidance
4	(a)	(i)	<p><b>identification</b> – desiccation cracks <b>OR</b> mud cracks ;</p> <p><b>formation</b> – <b>ANY 2</b> for 1 mark from:</p> <ul style="list-style-type: none"> <li>• form in hot and arid climate / desert environment / around edge of playa lake or sea <b>OR</b> high rates of evaporation</li> <li>• <u>mud / clay / fine sediment</u> dries out</li> <li>• (V shaped / polygonal) cracks open as the mud / clay contracts / shrinks</li> <li>• cracks are infilled with sediment ;</li> </ul>	1	
		(ii)	<p><b>identification</b> – graded bedding ;</p> <p><b>formation</b> – grains deposited in still water <b>OR</b> grains deposited due to loss of energy <b>AND</b> coarsest grains settle out first <b>OR</b> finest grains settle out last ;</p>	1	<b>IGNORE</b> references to turbidity currents
	(b)	<p>pebbles drawn shown leaning at an angle with at least one correct label, e.g. pebbles / clasts, river bed, pebbles dip upstream, tops lean downstream ;</p> <p>current direction correct for diagram drawn ;</p>		1	<b>DO NOT ALLOW</b> rocks instead of pebbles
	(c)	(i)	flute casts ;	1	<b>ALLOW</b> sole structures
		(ii)	<p>(turbidity) current scours sea floor creating hollow ;</p> <p>hollow infilled with sediment ;</p>	1	<b>ALLOW AW</b>
				1	<b>DO NOT</b> allow scouring of <u>bedrock</u>
				1	<b>MAX 1</b> for <b>ECF</b> if ripple marks identified in (c)(i)
		(iii)	<p><b>L</b> = greywacke ;</p> <p><b>M</b> = shale / mudstone / clay ;</p>	1	<b>DO NOT ALLOW</b> sediment names
				1	

Question	Answer	Marks	Guidance
(d)	<p><b>ANY 3 from:</b></p> <ul style="list-style-type: none"> <li>• <b>M</b> / shale / mud / clay / fine sediment is deposited from suspension <b>OR</b> shale / mud / fine sediment is deposited in low energy conditions ;</li> <li>• <b>M</b> / shale / mud / clay / fine sediment is 'normal' deposition / sedimentation in deep sea areas / far from land / far offshore (where there is no coarser sediment) ;</li> <li>• <b>M</b> / shale / mud / clay fine sediment are interturbidites <b>OR</b> shale / mud / fine sediment is deposited when turbidity currents are not operating ;</li> <li>• turbidity currents are started by an earthquake <b>OR</b> sediment avalanches down the continental slope <b>OR</b> sediment flows off the continental shelf ;</li> <li>• <b>L</b> / greywacke / coarser sediment is deposited from a turbidity current <b>OR</b> each turbidity current forms a unit of greywacke ;</li> <li>• greywacke forms in higher energy conditions (from a turbidity current) ;</li> <li>• turbidity currents are repeated events <b>OR</b> repeated turbidity currents form cyclothem <b>OR</b> repeated turbidity currents form repeated Bouma sequences ;</li> </ul>	<b>3</b>	answer <b>MUST</b> include both rock types for <b>MAX</b> marks
(e)	<p><b>ANY 2 from:</b></p> <ul style="list-style-type: none"> <li>• microorganisms (that live in the surface layers of the ocean) <b>OR</b> plankton <b>OR</b> nektonic microorganisms <b>OR</b> pelagic microorganisms ;</li> <li>• (on death) they sink / fall to the sea floor (to form beds / layers of ooze) ;</li> <li>• rates of deposition / sedimentation are about 1 mm per 1000 years ;</li> <li>• calcareous oozes form only above carbonate compensation depth / CCD <b>OR</b> the rate of deposition is greater than the rate of solution ;</li> </ul>	<b>2</b>	<b>ALLOW</b> correct named calcareous microfossils, e.g. foraminifera, globigerina, coccolithophores, coccoliths, calcareous algae <b>DO NOT ALLOW</b> radiolaria or bacteria rates of deposition / sedimentation are very slow is insufficient for mark
<b>Total</b>		<b>16</b>	

Question		Answer	Marks	Guidance
5	(a)	A mineral having two or more distinct forms <b>OR</b> different (crystal) structures <b>AND</b> the same chemical composition <b>OR</b> the same chemical formula ;	1	<b>ALLOW AW</b> answers <b>MUST</b> include both form <b>AND</b> composition
	(b) (i)	line drawn correctly from triple point to 600°C and 8 kb ;	1	
		<p>temperature (°C)</p> <p>0 100 200 300 400 500 600 700 800</p> <p>0 1 2 3 4 5 6 7 8</p> <p>0 5 10 15 20</p> <p>pressure (kb)</p> <p>depth (km)</p> <p>andalusite</p> <p>kyanite</p> <p>sillimanite</p>		
	(ii)	sillimanite ;	1	
	(iii)	kyanite ;	1	<b>ALLOW ECF</b> from (b)(i) the mineral found at 450°C and 15 km depth

Question	Answer	Marks	Guidance
(c)	<p>close to trench / top of subduction zone is zone of high pressure / low temperature metamorphism <b>OR</b> close to trench / top of subduction zone is blueschist zone <b>AND</b> due to compressive forces / collision <b>OR</b> due to deep burial in subduction zone <b>OR</b> due to low heat flow due to subduction of cold oceanic crust <b>OR</b> due to cold wet sediments in trench <b>OR</b> due to accretionary prism in trench ;</p> <p>volcanic island arc / inland from trench / further from trench is zone of low pressure / high temperature metamorphism <b>OR</b> volcanic island arc / inland from trench / further from trench is greenschist / amphibolite / granulite zone <b>AND</b> due to rising magma <b>OR</b> due to volcanic activity <b>OR</b> due to intrusion of batholiths <b>OR</b> due to partial melting <b>OR</b> low(er) pressure as further from point of collision of plates ;</p>	<p>1</p> <p>1</p>	<p><b>ALLOW AW</b></p> <p>each mark <b>MUST</b> include position of belt, temperature / pressure conditions and explanation</p> <p><b>MAX 1</b> for general correct descriptions of high pressure, low temperature <b>AND</b> low pressure, high temperature belts in correct locations</p>
(d)	(i) <p><b>texture</b> – schistosity <b>OR</b> porphyroblastic ;</p> <p><b>texture description</b> – aligned mica / aligned muscovite <b>OR</b> porphyroblastic garnet crystals <b>OR</b> large porphyroblasts surrounded by finer crystals <b>OR</b> large / 5mm garnet crystals and finer / 2mm muscovite crystals ;</p> <p><b>texture formation</b> – <u>micas / muscovite / flat minerals / platy minerals</u> aligned at right angles to pressure <b>OR</b> garnets have grown later (disrupting / distorting the micas) <b>OR</b> porphyroblasts grow later (disrupting / distorting the micas) <b>OR</b> garnet / porphyroblasts are large new crystals that grow during metamorphism ;</p>	<p>1</p> <p>1</p> <p>1</p>	<p>foliation is insufficient</p> <p>description <b>MUST</b> match named texture</p> <p><b>ALLOW</b> foliated mica as an alternative to aligned</p>
	(ii) <p><b>texture</b> – gneissose banding / gneissosity ;</p> <p><b>texture description</b> – dark and light bands <b>OR</b> layers of mafic minerals and felsic / silicic minerals <b>OR</b> layers of biotite and hornblende and layers of quartz and feldspar <b>OR</b> bands of coarse size crystals ;</p> <p><b>texture formation</b> – minerals segregate under high pressure / high temperature / high grade <b>OR</b> minerals align at right angles to pressure <b>OR</b> recrystallisation of muscovite forms K feldspar ;</p>	<p>1</p> <p>1</p> <p>1</p>	<p>foliation is insufficient</p> <p>segregation of minerals is insufficient <b>MUST</b> explain</p>
	<b>Total</b>	<b>12</b>	

Question			Answer	Marks	Guidance
6	(a)	(i)	<p><b>Era</b> – long(est) units of time <b>OR</b> subdivision of Eons <b>OR</b> time unit made up of Systems / Periods <b>OR</b> major unit of time that contains several Systems / Periods <b>OR</b> major unit of time divided on palaeontological change / mass extinction, e.g. Palaeozoic ;</p> <p><b>System</b> – (rocks laid down in) shorter periods of time, e.g. Cambrian ;</p>	1  1	<p><b>MAX 1</b> for one correct named example of an Era <b>AND</b> one correct named example of a System with no descriptions</p> <p><b>MAX 1</b> if 2 correct definitions but incorrect examples given</p>
		(ii)	<p>absolute / radiometric / specific named radiometric dating technique</p> <p><b>AND</b></p> <p>relative / using fossil evolution / using fossil succession / using superposition ;</p>	1	<b>DO NOT ALLOW</b> carbon dating
	(b)	(i)	<b>ALLOW</b> any number between 53 and 45 ;	1	
		(ii)	59 <b>OR</b> 59.1 ;	1	
		(iii)	<p><b>ANY 2</b> from:</p> <p>the longer the time interval between eruptions the higher the silica % due to fractional crystallisation / gravity settling / <u>more</u> differentiation ;</p> <p>dense mafic minerals / olivine / augite / pyroxene / low silica minerals sink to the bottom of the magma chamber over time <b>OR</b> early formed / high temperature mafic minerals / olivine / augite / pyroxene / low silica minerals sink to the bottom of the magma chamber over time <b>OR</b> gravity settling causes depletion of mafic minerals ;</p> <p>less dense / felsic minerals / late formed minerals / feldspar / more silicic magma is at the top of the magma chamber <b>OR</b> is erupted first ;</p>	2	<p><b>ALLOW</b> alternative words to more</p> <p><b>MAX 1</b> for general statement that formation of high temperature mineral(s) deplete the magma of Fe / Mg making it more silicic</p>
<b>Total</b>				<b>7</b>	



Question	Answer	Marks	Guidance
7	<p><b>weathering – ANY 3 from:</b></p> <ul style="list-style-type: none"> <li>• weathering is the breakdown of rock in-situ ;</li> <li>• chemical weathering produces solutes <b>OR</b> ions <b>OR</b> insoluble residue / minerals <b>OR</b> description of a method of chemical weathering ;</li> <li>• mechanical / physical weathering produces rock fragments / scree <b>OR</b> description of a method of mechanical /physical weathering ;</li> <li>• biological weathering produces fine rock fragments / soil <b>OR</b> description of a method of biological weathering ;</li> </ul>		<p>individual processes <b>MUST</b> be described not just listed to gain mark</p> <p><b>MARK</b> labelled rock cycle diagram / flow chart as text</p> <p><b>ALLOW</b> list of mechanical / physical, chemical and biological weathering <b>OR</b> named example of each for 1 mark</p>
	<p><b>erosion – ANY 3 from:</b></p> <ul style="list-style-type: none"> <li>• erosion is the removal / wearing away of weathered material ;</li> <li>• description of abrasion <b>OR</b> description of attrition ;</li> <li>• abrasion <b>OR</b> attrition makes grains / sediment more rounded / finer</li> <li>• erosion produces rock fragments by the physical action of transport ;</li> </ul>		<p><b>ALLOW</b> alternative definition of erosion - is caused by abrasion <b>AND</b> attrition if the two processes are not described</p>
	<p><b>transport – ANY 3 from:</b></p> <ul style="list-style-type: none"> <li>• method by which weathered material is moved from one place to another ;</li> <li>• description of an agent of transport – river <b>OR</b> sea <b>OR</b> wind <b>OR</b> ice <b>OR</b> gravity</li> <li>• description of a transport method in water – solution <b>OR</b> suspension <b>OR</b> saltation <b>OR</b> traction / bed load ;</li> </ul>		<p><b>ALLOW</b> list of 3+ agents of transport for one mark ;</p> <p><b>ALLOW</b> list of 3+ methods of transport in water for one mark ;</p>
	<p><b>deposition</b></p> <ul style="list-style-type: none"> <li>• deposition occurs when transporting agent loses energy <b>OR</b> when sediment is laid down ;</li> <li>• (layers of sediments form) in beds ;</li> </ul>		

Question	Answer	Marks	Guidance
	<p><b>diagenesis and burial – ANY 3 from:</b></p> <ul style="list-style-type: none"> <li>• <u>burial</u> occurs when sediment is covered by (younger) beds accumulating on top ;</li> <li>• diagenesis changes sediment into rock <b>OR</b> diagenesis is the processes that take place in sediments at low temperature and pressure close to the Earth's surface ;</li> <li>• description of cementation <b>OR</b> grains are cemented together by minerals ;</li> <li>• description of compaction <b>OR</b> grains are compacted by the weight of overlying rocks / overburden / load pressure ;</li> </ul>		<p><b>ALLOW</b> alternative definition of diagenesis - is caused by compaction <b>AND</b> cementation if the two processes are not described</p>
	<p><b>extrusion / volcanic activity</b></p> <ul style="list-style-type: none"> <li>• lava / magma / pyroclastics erupting at surface <b>OR</b> lava / magma / pyroclastics extruded from a volcano ;</li> <li>• formation of igneous rock at surface by rapid cooling <b>OR</b> crystallisation occurs when solid minerals / crystals form during cooling of magma / lava ;</li> </ul>		
	<p><b>hypabyssal intrusion</b></p> <ul style="list-style-type: none"> <li>• <u>hypabyssal / minor / dykes / sills / shallow level intrusions</u> form from magma ;</li> <li>• magma is forced into pre-existing rocks along joints / faults / bedding planes ;</li> </ul>		<p><b>DO NOT ALLOW</b> either marking point if batholith / plutonic intrusion is listed or described</p>
	<p><b>uplift</b></p> <ul style="list-style-type: none"> <li>• uplift of rocks to the surface by folding and faulting <b>OR</b> uplift of rocks to the surface as a result of Earth movements / tectonic forces ;</li> </ul>		
	<b>Total</b>	<b>10</b>	

Question	Answer	Marks	Guidance
8	<p><b>shale – MAX 8</b></p> <p><b>general points – MAX ANY 2</b> from:</p> <ul style="list-style-type: none"> <li>• rocks are unfoliated as no directed pressure ;</li> <li>• general diagram / description of the three zones around intrusion from <u>high grade</u> close to contact to <u>low grade</u> furthest away ;</li> <li>• 3 index minerals – biotite at low grade, andalusite at medium grade, sillimanite at high grade ;</li> <li>• 3 correct crystal sizes for the 3 grades ;</li> </ul> <p><b>low grade – MAX ANY 3</b> from:</p> <ul style="list-style-type: none"> <li>• rock is spotted rock ;</li> <li>• only partial recrystallisation <b>OR</b> relict fossils / bedding / pre-existing slaty cleavage may be present ;</li> <li>• spots of biotite / graphite / organic material / carbon / iron form ;</li> <li>• porphyroblasts of pyrite ;</li> <li>• <b>ANY 2</b> other minerals from: clay minerals <b>OR</b> quartz <b>OR</b> chlorite <b>OR</b> mica / muscovite <b>OR</b> cordierite ;</li> </ul> <p><b>medium grade – MAX ANY 3</b> from:</p> <ul style="list-style-type: none"> <li>• rock is andalusite rock ;</li> <li>• no relict structures remain ;</li> <li>• porphyroblastic ;</li> <li>• <b>ANY 2</b> minerals from: micas / biotite / muscovite <b>OR</b> andalusite / chiastolite <b>OR</b> cordierite <b>OR</b> quartz</li> </ul> <p><b>high grade – MAX ANY 3</b> from:</p> <ul style="list-style-type: none"> <li>• rock is hornfels ;</li> <li>• granoblastic texture <b>OR</b> interlocking mosaic of crystals ;</li> <li>• complete recrystallisation ;</li> <li>• hard / splintery rock formed ;</li> <li>• <b>ANY 2</b> minerals from: micas / biotite / muscovite <b>OR</b> quartz <b>OR</b> sillimanite <b>OR</b> mafic minerals / correct named mafic mineral ;</li> </ul>		<p><b>MARK</b> labelled diagrams as text</p> <p><b>DO NOT ALLOW</b> names and descriptions of regional metamorphic rocks</p> <p><b>ALLOW</b> spotted slate</p> <p><b>ALLOW</b> andalusite slate <b>OR</b> andalusite hornfels</p>

Question			Answer	Marks	Guidance
			<p><b>limestone – MAX ANY 3 from:</b></p> <ul style="list-style-type: none"> <li>• rock is marble <b>OR</b> composed of calcite ;</li> <li>• found anywhere within metamorphic aureole <b>OR</b> crystal size becomes coarser at higher temperatures / closer to intrusion ;</li> <li>• granoblastic texture <b>OR</b> sugary texture <b>OR</b> interlocking mosaic of crystals ;</li> <li>• fossils are destroyed <b>OR</b> impurities in the limestone give different colours / minerals ;</li> </ul>		<p><b>MARK</b> labelled diagrams as text</p> <p><b>ALLOW</b> saccharoidal texture</p>
			<b>Total</b>	<b>10</b>	

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