

Mark Scheme for June 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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Question			Answer	Marks	Guidance
1	(a)	(i)	A = brachiopod B = bivalve C = ostracod	1 1 1	
		(ii)	1 = pedicle valve 2 = pedicle foramen OR pedicle opening OR foramen 3 = umbo OR umbone 4 = growth lines	3	4 correct = 3 marks 3 correct = 2 marks 2 or 1 correct = 1 mark
		(iii)	hole that allows the pedicle to protrude (to attach to rocks)	1	ecf from (a)(ii)
		(iv)	(swimming or crawling on) on oxygenated sea bed OR benthonic OR epifaunal OR continental shelf	1	reject reference to energy levels accept shallow marine
		(v)	fossil A plane of symmetry across the centre of both valves B has plane of symmetry between the two valves	1	ecf from (a)(i) answer may be in 2 diagrams or text
	(b)		derived fossil OR reworked fossil OR (Jurassic) fossils weathered out of older rocks OR (Jurassic) fossils eroded out of older rocks; transported <u>and</u> redeposited in younger OR Quaternary rock	1 1	must have both description and explanation ALLOW eroded and redeposited for 1 mark

Question			Answer	Marks	Guidance
2	(a)	(i)	<p>fossil E crinoid stem section OR made of ossicles OR disarticulated stem OR soft tissue in centre has decayed</p> <p>fossil F trilobite pygidium OR fused plates OR divided into 3 parts axial lobe and 2 lateral lobes</p>	1 1 1 1	DO NOT ALLOW just stem
		(ii)	<p>fossil E energy level = low OR medium AND water depth = shallow marine</p> <p>fossil F energy level = low OR medium AND water depth = shallow marine</p>	1 1	<p>must have energy level and water depth for one mark OR both correct energy levels = 1 both shallow marine water depth = 1</p>
	(b)		<p>animals and plants living in environment; evidence of diet OR herbivore or carnivore; evidence of land areas OR terrestrial; large masses means large animals (ora); evidence of quick burial;</p>	2	<p>any 2 points</p> <p>allow second mark for high level of detail of one point</p> <p>treat references to energy levels and climate as neutral</p>
	(c)		<p>aragonite is unstable OR metastable OR needs to recrystallise to become stable OR more dense when recrystallized to calcite OR burial increase in heat with diagenesis</p>	1	

Question		Answer					Marks	Guidance	
	(d)	(i)		numbers of solitary corals in life position	number of bivalve shells		total number of bivalve shells	% 'convex up' bivalve shells	
					'convex down' 	'convex up' 			
			bedding plane	1	12	58	52	110	47.3
				2	3	25	110	135	81.5
3	8	47		40	87	46.0			
		(ii)	<p>bed 3 has random pattern of convex up shells OR roughly 50 : 50 of convex up shells means that there is little current OR medium number of corals in life position, indicates deposition in low to medium energy conditions;</p> <p>bed 2 is higher energy conditions as higher energy waters turn the shells over OR high energy causes a greater percentage to be convex up OR high energy causes the disarticulated shells to be convex up OR fewer corals in life position;</p> <p>bed 1 has the most corals so has the clearest waters OR roughly 50 : 50 of convex up shells in bed 1 means that there is little current OR most corals in life position, so low to medium energy;</p> <p>description of energy changing from low or medium bed 3, to high bed 2 and back to low or medium bed 1 means changing environments;</p> <p>use of numbers correctly used to describe a relationship with reasons;</p> <p>presence of corals so must be tropical conditions OR ideal conditions for coral growth OR clear, shallow sea OR with normal salinity;</p>					4	<p>points for each bed must have the interpretation and a link to the environment for 3 marks</p> <p>additional marks can be for detail attached to beds 1, 2 or 3 OR be part of the general statements provided</p> <p>treat bed 1 as youngest and 3 as oldest</p> <p>corals on specification are high energy for well oxygenated water but solitary corals are lower energy therefore allow reverse argument</p> <p>answers are by bed</p> <p>max 1 for general statement without discussing separate beds</p>

Question			Answer	Marks	Guidance
		(iii)	look for disarticulated crinoids OR other fossils disarticulated to show high energy; look for other evidence of life in the sediments eg burrows; look for sedimentary structures that suggest high energy like cross bedding; life assemblage OR whole fossils; look for evidence of current alignment;	1	allow evidence of winnowing if explained any 1 point
			Total	16	

Question	Answer	Marks	Guidance
	(iv) fossil G has siphuncle in the centre AND fossil H has siphuncle at the outer edge siphuncle labelled OR shaded on both drawings	1 1	siphuncle position for both fossils must be described
	(v) fossil G has simple curve of nautiloid OR orthocone suture fossil H has complex ammonitic suture	1 1	
	(d) evolve rapidly so that there are new forms found in different beds OR time periods OR short stratigraphic range; distinct or easily identifiable forms allows them to be identified in the field OR can be clearly matched to specific beds; abundant so that they are easily found; pelagic or nektonic mean they have a wide distribution OR are found in many different rock types OR are facies independent	2	max 1 for list of three or more facts with no explanation any 2 explanations.
	Total	18	

Question	Answer	Marks	Guidance
<p>4 (a) (i)</p>		<p>2</p>	<p>Correlation possible on:</p> <ul style="list-style-type: none"> • base of mudstone • base of conglomerate or top of coal • base of coal <p>correlation of one bed = 1 mark correlation of two beds = 2 marks</p>
<p>(ii)</p>	<p>description environment J – mudstone is a deep water deposit OR mudstone is a shallow water low energy deposit OR flood plain deposit OR increased water depth from conglomerate to mudstone;</p> <p>environment L – contains high energy shallow water deposits such as conglomerates and sandstones (eg beach or river deposits) OR coal represents land OR coal represents a swamp OR coal may be deltaic</p> <p>reason for differences the boreholes are 5 km apart and deltas vary laterally OR sea level is fluctuating all the time and affects different areas differently OR delta builds out at different rates OR deposition of bed thickness varies across delta OR lateral variation from shallow marine to terrestrial environment.</p>	<p>2</p> <p>1</p>	<p>1 mark if J identified as deep sea 1 mark if L identified as close to land or on land</p> <p>1 mark for general point that J is mainly mudstone so low energy and L is more sandstone so higher energy</p> <p>any 2 description points</p>

Question	Answer	Marks	Guidance																
(b)	<p>counting bands of sediment OR varves can be counted to give an absolute date;</p> <p>lake sediment deposited in different seasons OR spring has coarser deposits AND winter has little or no deposits OR light and dark layers represent different seasons;</p> <p>patterns of beds can correlated OR beds in a sequence of thick and thin layers, can be matched;</p> <p>annual events appear as 2 beds OR coarser sediment and fine organic rich layer is an annual event;</p>	3	<p>accept carbon 14 dating of organic material in varves</p> <p>any 3 points.</p>																
(c)	<p>(i)</p> <table border="1" data-bbox="340 679 1301 963"> <thead> <tr> <th data-bbox="340 679 595 715"></th> <th colspan="3" data-bbox="595 679 1301 715">fossil group</th> </tr> <tr> <th data-bbox="340 715 595 750"></th> <th data-bbox="595 715 837 750">graptolites</th> <th data-bbox="837 715 1061 750">tabulate corals</th> <th data-bbox="1061 715 1301 750">Trilobites</th> </tr> </thead> <tbody> <tr> <td data-bbox="340 750 595 858">first appearance</td> <td data-bbox="595 750 837 858"><i>Upper Cambrian</i></td> <td data-bbox="837 750 1061 858">Ordovician OR Cambrian</td> <td data-bbox="1061 750 1301 858"><i>Lower Cambrian</i></td> </tr> <tr> <td data-bbox="340 858 595 963">extinction</td> <td data-bbox="595 858 837 963">Silurian OR Lower Devonian</td> <td data-bbox="837 858 1061 963"><i>Upper Permian</i></td> <td data-bbox="1061 858 1301 963">Permian OR Carboniferous</td> </tr> </tbody> </table>		fossil group				graptolites	tabulate corals	Trilobites	first appearance	<i>Upper Cambrian</i>	Ordovician OR Cambrian	<i>Lower Cambrian</i>	extinction	Silurian OR Lower Devonian	<i>Upper Permian</i>	Permian OR Carboniferous	2	<p>2 or 3 correct for 2 marks 1 correct for each mark</p>
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	graptolites	tabulate corals	Trilobites																
first appearance	<i>Upper Cambrian</i>	Ordovician OR Cambrian	<i>Lower Cambrian</i>																
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(ii)	<p>changing conditions due to large-scale glaciation OR desertification so organisms did not have enough time to adapt to changing conditions</p> <p>increased competition for shallow marine dwellers due to reduction of shallow seas OR formation of Pangaea reduces continental shelf; reduced input of sediment and organics from continents reduced food supply;</p> <p>large-scale volcanic eruptions OR ash from eruption of Siberian Traps affecting food chains / life; poisonous gases or ash emitted into the atmosphere lowered global temperatures; emissions of greenhouse gases caused temporary global warming;</p> <p>possible meteorite impact causing dust in atmosphere and global cooling and warming;</p> <p>change in temperature of the sea OR changes in salinity OR changes in pH OR acid rain, causes death; links with mass extinction at Permo-Triassic boundary;</p>	4	<p>max 1 for list of three or more causes without an explanation</p> <p>must have description linked to explanation</p> <p>any 3 causes with explanation for 3 marks</p> <p>allow one mark for detailed description of any point in context</p> <p>allow methane hydrates if discussed in context for 1 mark</p>
	Total	14	

Question			Answer	Marks	Guidance
5	(a)	(i)	changes in organisms over time OR gradual evolution; organisms over-reproduce; adaptation to the environment; can pass on information (genes OR alleles) more effectively OR beneficial mutations cause evolutionary change; survival of the fittest OR natural selection OR selection pressures, mean some organisms survive whilst others don't; suitable example of organism or fossil that illustrates evolution eg Darwin's finches, trilobites etc;	2	any 2 points
	(b)	(i)	scleroprotein / protein	1	ALLOW chitin
		(ii)	pendant	1	
		(iii)	P youngest M N oldest	2	1 mark if one correct
		(iv)	live as colonies OR colonial; filter feeders OR use common canal; graptolites float OR live in water column OR planktonic OR nektonic OR swim; facies independent OR anywhere in the surface waters of the ocean; have gas or fat filled buoyancy attachment OR attached to seaweed or other floating material	3	any 3 points.

Question	Answer	Marks	Guidance
(c) (i)	hollow thin walled bones; s shaped neck; elongate arms OR forelimbs OR clawed hands OR clawed feet; reversed first toe; three toed feet; elongate metatarsels or wrist OR ankles; elongate phalanges OR toes; bipedal as both stand on 2 legs; large orbits in skull for eyes OR bigger eyes; hinged ankles or wrists OR similar bone structure in the ankle or wrists; feathers OR wings; furcula; both laid eggs;	2	
	(ii) <i>hollow thin-walled bones</i> to make the bones lighter for flying <i>S-shaped neck</i> for greater flexibility OR ideas about the adaptation <i>elongate arms OR forelimbs OR clawed hands</i> for catching prey OR collecting food <i>large orbits in skull for eyes OR bigger eyes</i> for spotting predators or prey OR to escape from predators <i>hinged ankles</i> to reduce rotation of ankle and increase stability when not flying <i>feathers or wings</i> to enable flight <i>eggs</i> protection of young OR allow offspring to be left whilst hunting	1	must be an explanation for the feature chosen to get a mark. any 1 feature

Question		Answer	Marks	Guidance												
	(iii)	furcula OR hollow bones OR feathers OR wing like structures OR claws	1													
	(d)	<table border="1"> <thead> <tr> <th>statement</th> <th>true or false ✓ or X</th> </tr> </thead> <tbody> <tr> <td>early amphibians and lobe-finned fish had limbs in the same position on their bodies</td> <td>✓</td> </tr> <tr> <td>the lobe-finned fish had a narrower skull than the amphibians</td> <td>X</td> </tr> <tr> <td>early amphibians had small bony scales on their skin</td> <td>✓</td> </tr> <tr> <td>early amphibians and lobe-finned fish had complex teeth</td> <td>✓</td> </tr> <tr> <td>early amphibians and lobe-finned fish had claws</td> <td>X</td> </tr> </tbody> </table>	statement	true or false ✓ or X	early amphibians and lobe-finned fish had limbs in the same position on their bodies	✓	the lobe-finned fish had a narrower skull than the amphibians	X	early amphibians had small bony scales on their skin	✓	early amphibians and lobe-finned fish had complex teeth	✓	early amphibians and lobe-finned fish had claws	X	4	five correct = 4 marks four correct = 3 marks three correct = 2 marks one or two correct = 1 mark
statement	true or false ✓ or X															
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early amphibians and lobe-finned fish had claws	X															
Total			17													

Question	Answer	Marks	Guidance
6	<p>labelled diagrams showing irregular echinoid labelled diagrams showing regular echinoid</p> <p>similarities</p> <ul style="list-style-type: none"> • composed of plates of calcite OR skeleton made of plates • different plates <u>ambulacra</u> and <u>interambulacra</u> • have tube feet for respiration OR attachment OR water control • have pore pairs for tube feet protrusion • water based circulatory system (and madreporite) OR respiration using a water vascular system • both have spines (although of different types) OR tubercles <p>differences</p> <ul style="list-style-type: none"> • regular – five fold radial symmetry OR circular • irregular – bilateral symmetry OR heart shaped; • regular – mouth central on oral surface; • irregular – mouth moves to anterior position; • regular – mouth has jaws OR Aristotle’s lantern; • irregular – no jaws; • regular – no labrum; • irregular – labrum to protect mouth; • regular – anus central on top OR on aboral surface • irregular – anus moves posteriorly OR anus moves out of apical system OR apical system no longer radial; • regular – no sub-anal fasciole OR fasciole not needed; • irregular – has sub-anal fasciole OR more cilia for waste; 	<p>1</p> <p>1</p> <p>1</p> <p>1</p> <p>1</p> <p>1</p> <p>1</p> <p>1</p> <p>1</p> <p>1</p> <p>1</p> <p>1</p> <p>1</p>	<p>Max 4 for similarities</p> <p>Max 6 for differences Each difference must refer to both groups.</p> <p>ALLOW regular mouth and anus on opposite sides and irregular mouth and anus on same surface for 1 mark</p>

Question			Answer	Marks	Guidance
			<ul style="list-style-type: none"> regular – no anterior groove OR not needed; irregular – has anterior groove OR cilia to direct currents; 	1	
			<ul style="list-style-type: none"> regular – ambulacra extend from anus to mouth OR from top to bottom; irregular – petaloid ambulacra; 	1	
			<ul style="list-style-type: none"> regular – no plastron; irregular – plastron develops on underside; 	1	
			<ul style="list-style-type: none"> regular – may have large spines all over test OR may have large tubercles on test; irregular – may have spines only on plastron OR tubercles on plastron OR test lacks spines OR test lacks tubercles; 	1	
			Total	10	

Question	Answer	Marks	Guidance
7	<p><i>replacement</i></p> <ul style="list-style-type: none"> • original material dissolved by groundwater • replacement may be atom by atom • substituted for another named mineral haematite OR pyrite OR silica; • may be the change from aragonite to stable calcite • groundwater rich in dissolved minerals • example of common replacement OR shells OR bivalves <p><i>silicification</i></p> <ul style="list-style-type: none"> • groundwater rich in SiO₂ moves through rock • crystallises out of solution OR silica forms crystals • fills voids or pores in rock or fossils • silicification is common in wood OR increase in density as original material not dissolved • example of common replacement OR shells OR petrified wood OR echinoids <p><i>carbonisation</i></p> <ul style="list-style-type: none"> • (mass of overlying rocks) increases the pressure (and temperature) • volatiles in rock (gases) escape • detail of volatiles such as CH₄, CO₂, O₂ and H₂O • organic matter increases percentage C content • preserved as a black OR dark film OR carbon films OR usually in mudstone or shale • example of common carbonisation plant OR graptolites OR fish OR reptiles 	<p>1</p>	<p>treat the burial of original fossil as neutral in all answers</p> <p>max 4 for replacement</p> <p>ALLOW special / specific type of replacement</p> <p>max 4 for silicification</p> <p>max 4 for carbonisation</p>
	Total	10	

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