OCR
RECOGNISING ACHIEVEMENT

GCE

Geology

Advanced GCE

Unit **F795:** Evolution of Life, Earth and Climate

Mark Scheme for January 2012

Oxford Cambridge and RSA Examinations

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Mark schemes should be read in conjunction with the published question papers and the report on the examination.

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Annotations

Annotation	Description
	Tick
	Cross
	Benefit of Doubt
	No Benefit of Doubt given
	Error carried Forward
	Omission mark
	Ignore
	Reject

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
SEEN	Point has been noted
R	Reject

Question			Answer	Marks	Guidance
1	(a)	(i)	A = coral OR rugose OR cnidarian OR anthozoa B = conodont C = gastropod D = trilobite (enrolled)	1 1 1 1	ALLOW genus name if correct
		(ii)	1 = columella OR axial structure 2 = dissepiments 3 = septum 4 = glabella 5 = compound eye OR ALLOW eye	4	5 or 4 correct = 4 3 correct = 3 2 correct = 2 1 correct = 1 ALLOW cephalon OR cephalic shield for 4
		(iii)	strength OR integrity to structure OR scaffolding OR links the septa together	1	ecf but not if microfossil stated
		(iv)	composition = apatite OR calcium phosphate function = teeth for biting or slicing OR part of jaw OR teeth	1 1	ecf from above
		(v)	correct labelling of any 2 from: helical coiling OR dextral coiling OR spire OR body chamber OR suture OR ornament OR whorl OR aperture OR apex OR outer lip any 2	1	two correct labels for 1 mark
		(vi)	soft substrate (to enable burial of spire into sediment) OR shallow seas	1	ecf DO NOT ALLOW energy level as this varies ALLOW muddy OR sandy as alternative to soft substrate

Question			Answer	Marks	Guidance
		(vii)	many thoracic segments OR pleura OR many legs gives ability to enroll for protection OR gives flexibility in the carapace OR exoskeleton many thoracic segments OR pleura OR many legs means less likely to be a swimmer OR more likely to be a crawler or bottom dweller large eyes OR eyes on top OR upward and forward and sideways vision OR 360^{o} vision for moving on sea floor OR as evidence for benthonic mode of life OR means they probably lived on the substrate not in burrows OR lives where there is light so not very deep OR use eyes for hunting or scavenging or looking out for predators any 2	2	ecf most likely answer for ecf is strong ribs mean high energy environment the evidence must be shown on the diagram mark in pairs; must have one piece of evidence **and** the deduction of the mode of life for one mark
	(b)	(i)	drawing of brachiopod attached to substrate via pedicle any two suitable labels from: pedicle OR fleshy stalk OR pedicle opening OR pedicle valve OR brachial valve OR foramen	1 1	
		(ii)	lophophore composed of sticky filaments; filaments are lined with cilia OR cilia beat to generate currents; (inhalant) current brings in food particles; cilia or mucus or sticky lophophore trap particles; particles passed to mouth OR food wafted to mouth; waste material removed by cilia beating in reverse OR on exhalent current; any 2	2	ALLOW tentacles or hairs instead of cilia
			Total	**19**	

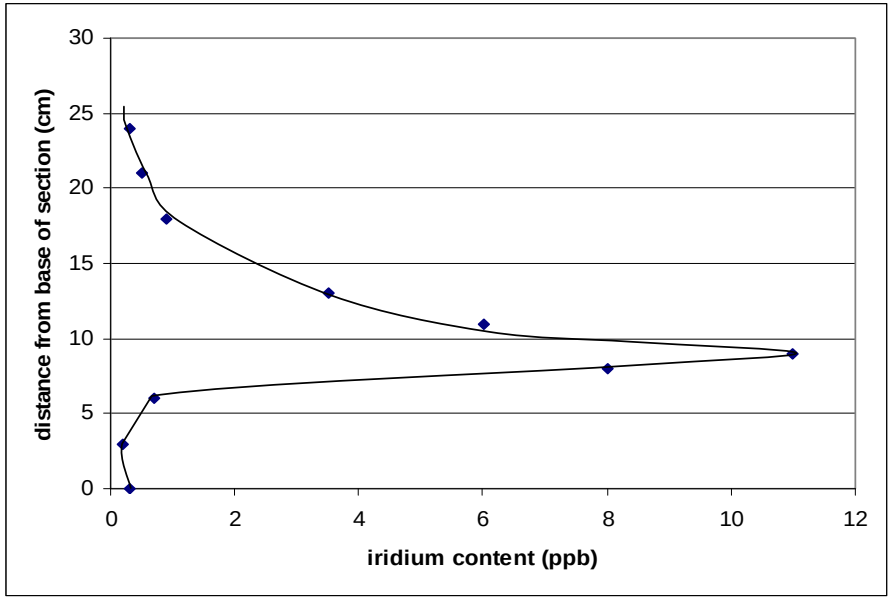
Question			Answer	Marks	Guidance
2	(a)		pyritisation body fossil tar replacement diagenesis amber	5	one correct = 0 marks two correct = 1 mark three correct = 2 marks four correct = 3 marks five correct = 4 marks all six correct = 5 marks
	(b)		(dead) organism buried in sediment; decay of organism's soft parts leaving empty shell; inside of shell infilled by sediment or precipitated minerals; groundwater dissolves original shell material; groundwater allows replacement of original shell material OR precipitation of named mineral (for example calcite, quartz or pyrite) from groundwater; internal and external mould drawn and labelled; internal and external cast drawn and labelled; any 4	4	groundwater movement may be labelled as arrows max 3 if internal and external features are not labelled max 3 if no diagrams 2 marks for 4 of internal mould, external mould, internal cast, external cast in any combination drawn and labelled
	(c)		*transport distance* increased transport means increased attrition or abrasion or breakage OR more transport of fossil means less well preserved fossils or damaged fossils *particle size* fine sediment preserves fossils best OR coarse sediment does not preserve fossil well OR large particles allow increased porosity for movement of fluids so poor preservation OR fine sediment allows detail of fossil to be preserved *diagenesis* early diagenesis means better preservation OR replacement can preserve the fossil well OR solution or dissolution destroys the fossil OR diagenesis destroys fossils by increases in pressure and/or temperature	1 1 1	

Question			Answer	Marks	Guidance
	(d)	(i)	organism burrows in soft sediment OR named organism burrows (eg worm OR crustacean OR bivalve) OR infilling of burrows	1	
		(ii)	found on the top bed below the unconformity OR where the bed was on the sea floor for a long period of time OR bored surfaces OR burrows infilled by material found above the unconformity	1	
		(iii)	low energy; rapid sedimentation; fine sediment; soft substrate any 2	1	two points needed for one mark
	(e)	(i)	C it has the shortest time range OR C has the most limited time range OR C is limited to one bed	1	mark is for explanation
		(ii)	Bed 3 it has the most ammonites in it OR bed 3 contains all but one of the fossils	1	mark is for explanation
		(iii)	top of the bed is the extinction of fossil E and the bottom is the first appearance of fossil D OR Bed 2 has an assemblage of A, D, E and F	1	

Question			Answer	Marks	Guidance
	(f)		fossils are destroyed before burial **by** decay OR predation OR transport OR erosion OR weathering; fossils are destroyed after burial **by** dissolution in groundwater OR diagenesis OR melting OR metamorphism; record biased to fossils with hard parts OR only robust hard parts preserved **as** only hard parts are generally preserved; most soft bodied organisms or soft parts are not generally preserved **as** they decay or are eaten; exceptional preservation where soft parts or soft bodied organisms are preserved **only** happens in unusual conditions of low energy and rapid burial in anoxic fine sediment; the fossil record only contains a fraction of the organisms that were present in any environment **as** most are not preserved; not all fossils have been found **as** there are many areas still to look in OR new exposures open up; terrestrial fossils OR land animals are less likely to be preserved **due to** high energy environment OR surface processes; ORA any 3	3	each statement must be explained for the mark ALLOW suitable hard bodied example ALLOW suitable soft bodied example such as worms or jellyfish
			Total	**21**	

Question			Answer	Marks	Guidance
3	(a)	(i)	swampy OR marshy OR deltaic OR terrestrial; tropical OR equatorial conditions; trees die and fall into the swamp or water; conditions are low energy; (water) anoxic OR (sediment) anaerobic OR no decay of material; rapid sedimentation (occurs to preserve plant matter before decay); burial in fine sediment;	2	any 4 points listed for 2 marks or any 2 points listed for 1 mark
		(ii)	four fins of the fish and four limbs of the amphibians OR fins and limbs are in the same position OR fin and limb bones are in a similar arrangement; both lacked claws OR nails; skull OR jaw and teeth structures are very similar; both had scales on the skin; any 2	2	DO NOT ACCEPT soft tissue or eggs
		(iii)	development of a girdle to connect the limb bones of the skeleton; for better movement; robust skeleton OR strengthened vertebral column OR rib bones; to support body on land; fin bones become limb bones OR development of legs; to allow movement on land; bones in the limbs develop into toes; for clinging; fused leg bones allow walking any 2	2	linked description and reason needed for two marks ALLOW 1 soft bodied feature with explanation eyelids to keep eye moist double loop circulatory system to increase gas exchange external ears to detect sound or detect predators / prey tongue to catch prey

Question			Answer	Marks	Guidance
	(b)	(i)	no rings suggests no change in seasons; different sized tree rings means changes with seasons and difference in conditions from one year to the next; any 1	1	
			conditions good for growth of trees ie hot <u>and</u> humid OR extinct fast growing trees; trees do not grow that high in UK today any 1	1	
		(ii)	equatorial OR hot wet tropical	1	DO NOT ALLOW just tropical
	(c)		presence of corals OR reef limestone corals only grow in tropical latitudes today OR conditions not present in UK today oolitic limestone only forms where calcite is being precipitated in warm tropical seas red bed sediments, especially in Scotland; were from a tropical oxidising environment OR hot desert Coal Measures and associated sediments; suggests equatorial / tropical environment; any 2	2	mark in pairs; must have one piece of evidence with its explanation for one mark ALLOW palaeomagnetism measurements that show a palaeolatitude close to the equator isotopic evidence using oxygen or carbon show changes in temperature
			Total	**11**	

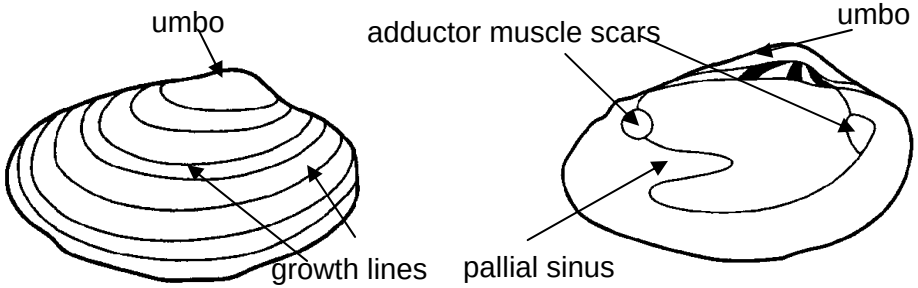
Question			Answer	Marks	Guidance
4	(a)	(i)	4 points of values greater than 1 plotted correctly = 1 mark line of best fit = 1 mark  	1 1	one mark for doing a line of best fit based on their plotted marks even if points incorrect. no marks for straight lines of best fit
		(ii)	a line at 9cm above the base, + / - 1 OR vertically in line with maximum value at 11 for iridium	1	
		(iii)	raised levels of iridium from outside the Earth system OR mainly extraterrestrial origin OR more abundant in space OR iridium found in meteorites / asteroids; low levels of iridium naturally on Earth; iridium possibly from meteorite collision / impact at KT boundary; iridium found in clay as dust from meteorite thrown into atmosphere settled onto land and sea. any 2	2	

Question			Answer	Marks	Guidance
	(b)		<u>description</u> large scale eruptions produce a lot of volcanic products into the atmosphere (for example ash and gas); Siberian trap eruptions huge so produce large amounts of ash / dust / gas <u>explanation</u> volcanic winter or global cooling caused by ash / dust blocking out sunlight so reducing temperature; volcanic gases dissolved in water to form acid rain or acidification of water; ash / dust traps heat causes global warming OR CO_2 and SO_2 gases cause greenhouse warming; light blocked out causes plants to stop photosynthesising; food chains disrupted if plants die; any 3	3	max 2 for description and max 2 for explanation
	(c)		description of two relevant methods and explanation of how each is used <u>cross cutting relationships</u> where a feature such as a dyke or fault cuts across beds; used to date beds between two events OR if dyke has radiometric age can be older than a specific age in Ma OR cross cutting feature must be youngest; <u>included fragments</u> where eroded rock fragments from a bed are included in a another bed OR xenoliths form in a batholith due to stoping; used to show which way up a sequence is OR fragments / xenolith must be older than bed / intrusion; <u>way up structures</u> desiccation cracks have a clear pattern or V shaped cracks infilled OR graded bedding has smaller grains at the top, coarser at base OR cross bedding is U shaped or has cut off beds; used as each can be identified as inverted or not so can identify youngest bed;	4	mark labelled diagrams as text 1 mark for description of method and 1 for explanation for each of two methods Oldest rocks must be distinguished from youngest for explanation ALLOW specific sequence of named fossils stating younger and older fossils. do not allow ripples or imbricate structure do allow flute casts

Question			Answer	Marks	Guidance
	(d)	(i)	lithostratigraphy	1	
		(ii)	<u>definition</u> diachronous rocks are composed of similar sediments but deposited at different times OR a bed of rock that cuts across time OR a bed that forms across time planes <u>explanation</u> correlation may result in correlation of rock units that are of completely different ages OR it may appear that rocks are identical in one area compared with another OR change of age laterally in a bed eg prograding delta sand or a marine transgression	1 1	
			Total	**15**	

<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Marks</th><th>Guidance</th></tr>
<tr><td>5</td><td>(a)</td><td>(i)</td><td>
<table>
<tr><th>features</th><th>options</th></tr>
<tr><td>has two identical valves, left and right</td><td>(true) false</td></tr>
<tr><td>does not have a foot</td><td>true (false)</td></tr>
<tr><td>has a ligament to hold the valves closed</td><td>(true) (false)</td></tr>
<tr><td>bilaterally symmetrical about a medial plane of symmetry</td><td>true (false)</td></tr>
<tr><td>is composed of calcium carbonate</td><td>(true) false</td></tr>
<tr><td>has a pallial line</td><td>(true) false</td></tr>
<tr><td>has two teeth within the hinge apparatus of the pedicle valve</td><td>true (false)</td></tr>
</table>
</td><td>4</td><td>no marks gained for one correct

7 or 6 correct = 4 marks
5 correct = 3 marks
4 correct = 2 marks
2 or 3 correct = 1 mark</td></tr>
</table>

Question			Answer	Marks	Guidance
		(ii)		2	umbo labelled on either diagram two or three correct = 1 mark four correct = 2 marks
	(b)	(i)	***high energy marine environment on a rocky shore*** diagram with minimum of 2 morphological labels of suitable form for example *Mytilus OR Ostrea* ***for Mytilus*** living in groups OR many live together for protection attachment by byssus elongate OR streamlined shells for strength against wave action; strong adductor muscles to hold shell together to stop dehydration layer of periostracum to allow the shell to survive in brackish water ***for Ostrea*** strong adductor muscle to hold shell together when tide out OR monomyarian thick shells for strength against wave action living in groups OR many live together for protection attachment by cementation heavy ribbed shell for strength (*Trigonia* type) any 2	1 2	mark diagrams as text each marking point must have a feature and an explanation

Question			Answer	Marks	Guidance
		(ii)	***low energy marine environment with soft muddy substrate*** diagram with minimum of 2 morphological labels of suitable form for example *Gryphaea* OR *Pecten* OR *Solen* ***for Gryphaea*** large left valve has large resting area OR snowshoe of large (left) valve so can be free lying; large valve spreads out mass to stop sinking OR growth lines may grip sediment; smaller (right) valve out of sediment for feeding OR forms lid like valve incurved umbo OR thick shells for stability ***for Pecten*** monomyarian OR one large muscle to close shells rapidly OR to allow swimming; thin OR corrugated OR ribbed shells OR spines to spread mass and stop sinking; large flat valve for large surface area OR for strength with minimum mass; ears to direct flow of water ***for Solen or Ensis or Mya or other burrowers*** elongate shells OR streamlined shells OR smooth shells with growth lines to move through the sediment; pallial sinus formed where siphons extend out; small ligament and/or adductor muscle scars as shell rarely opened; gapes in *Solen* types for siphons and where foot extended out OR gape in *Mya* types where foot extended out; thin shell as protected living in the sediment; any 2	1 2	mark diagrams as text max 2 for shallow burrower / vagrant form each marking point must have a feature and an explanation
	(c)	(i)	modern bivalves are adapted to live in different environments with different morphological features present for each environment; specific example of morphological feature such as gape or pallial sinus identifies a specific mode of life; can be used to identify palaeoenvironments OR we assume that similar bivalves in the past lived in the same environments as they do today; Law of Uniformitarianism OR explanation of past processes are operating today; any 2	2	
			Total	**14**	

Question			Answer	Marks	Guidance
6			*Diagrams* • diagrams with minimum of 2 morphological labels of pendent / two stiped; • diagrams with minimum of 2 morphological labels of biserial <u>and</u> uniserial, single stiped; • diagrams with minimum of 2 morphological labels of scandent form; • diagrams with minimum of 2 morphological labels of thecal shape; *Information* • early forms (Ordovician) had numerous stipes to 4 stipes (*Tetragraptus);* • later (Ordovician) forms two-branched pendant (*Didymograptus)*; • reclined or horizontal forms develop after pendant forms; • early forms have simple theca; • single branched forms with thecae back-to-back OR biserial (*Diplograptus) ;* • mixed forms like (D*icellograptus)* evolved to scandent (in late Ordovician and early Silurian); • sigmoidal thecae evolved; • single stipe colonies (*Monograptus); (*Silurian*)* • uniserial <u>and</u> scandent; • detail of simple / sigmoidal / hooked / isolate theca OR details of thecal shapes; • complex forms of curves and spirals; **OR General trends** • later forms with complex / varied thecal types compared to early forms; • the direction of growth of the stipes evolved from pendant to scandent; • general evolution from forms with more stipes to forms with few or only one stipe; • evolution starts in early Ordovician and continues to end Silurian;	1 1 1 1 Max 3 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 Max 8	Answers that are diagrammatic lists max 5 mark well annotated diagrams as text genus names are not essential general evolutionary trends as alternative to detail in each section
			Total	**10**	

Question			Answer	Marks	Guidance
7			*diagrams* • labelled diagrams to show internal morphology of a nautiloid • labelled diagrams to show internal morphology of an ammonoid • labelled diagrams to show external morphology of a nautiloid and ammonoid • labelled diagrams to show suture lines	1 1 1 1 Max 3	mark well annotated diagrams as text Answers with full marks must include similarities and diagrams
			similarities • both nautiloids and ammonoids have chambered OR coiled shells • both have chambers connected by a siphuncle • animal lives in final chamber OR soft tissue of animal extends out of shell OR animals have tentacles and eyes OR funnel • gas or liquid in chambers helps control buoyancy	1 1 1 1 Max 3	
			differences in internal morphology • position of siphuncle (eccentric) in ammonoids <u>and</u> position of siphuncle (central) in nautiloids • different suture types from straight OR simple OR orthoceratitic suture for nautiloids <u>and</u> ammonitic OR complex OR frilly for ammonoids • septal necks point towards the aperture in ammonoids <u>and</u> septal necks point towards the protoconch in nautiloids	1 1 1	
			differences in external morphology • ornament poor on nautiloid shells / only growth lines <u>and</u> ornament described on suitable ammonoids (for example ribs, tubercles, keel) • very small umbilicus in nautiloids <u>and</u> can be wide in ammonoids • ammonoids may be involute or evolute <u>and</u> nautiloids only involute • ammonoids can have sharp keel or sulcus while nautiloids do not	1 1 1 1 Max 5	
			Total	**10**	

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

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Education and Learning
Telephone: 01223 553998
Facsimile: 01223 552627
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