OCR
RECOGNISING ACHIEVEMENT

GCE

Geology

Advanced GCE

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

Mark Scheme for January 2013

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This mark scheme is published as an aid to teachers and students, to indicate the requirements of the examination. It shows the basis on which marks were awarded by examiners. It does not indicate the details of the discussions which took place at an examiners' meeting before marking commenced.

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
BOD	Benefit of doubt given
CON	Contradiction
	Incorrect response
ECF	Error carried forward
I	Ignore
NBOD	Benefit of doubt not given
PD	Poor Diagram
R	Reject
SEEN	Point has been noted, but no credit has been given
	Correct response
^	Omission mark
MR	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)	(i)	**A** phylum = arthropoda / arthropod group = trilobita / trilobite **B** phylum = echinoderm / echinodermata group = echinoidea / echinoid / irregular echinoid **C** phylum = mollusca / mollusc group = bivalvia / bivalve	3	6 correct = 3 marks 5 or 4 correct = 2 marks 3 or 2 correct = 1 mark **ALLOW** if correct genus given for group **DO NOT ALLOW** regular echinoid
		(ii)	1 = glabella 2 = pygidium **OR** axis **OR** axial lobe 3 = one interambulacral plate **OR** interambulacral **OR** calcite plate **OR** interambulacra 4 = dentition **OR** teeth and sockets **OR** tooth **OR** sockets **OR** teeth	3	4 correct = 3 marks 2 or 3 correct = 2 marks 1 correct = 1 mark **DO NOT ALLOW** lateral teeth
		(iii)	**fossil A** feature: no eyes reason: it would not need any if it lived in a burrow **OR** in low light **OR** in the substrate **OR** buried in mud; feature: wide cephalon / cephalic shield **OR** large cephalon / cephalic shield **OR** shovel shaped cephalon / cephalic shield reason: to spread mass on soft substrate to prevent sinking **OR** to dig a burrow; feature: long genal spines reason: to spread mass on soft substrate to prevent sinking; feature: pitted cephalon **OR** pitted cephalic fringe **OR** pits for sensory hairs reason: to detect the environment **OR** currents **OR** to detect movement **OR** to detect prey **OR** because it had no eyes; feature: few pleura **OR** few segments **OR** few legs reason: legs not needed for walking;	2	the identified morphological feature and reason must be in pairs for 1 mark each **ALLOW** 2 correct features for max 1 mark

Question			Answer	Marks	Guidance
			fossil B feature: petaloid ambulacra **OR** pore pairs on the top reason: to allow the extension of tube feet upward out of the burrow **OR** efficient gas exchange **OR** respiration; feature: smooth test **OR** no (distinct) spines reason: to allow easy movement in the burrow; feature: heart shaped reason: to give it a streamlined shape **OR** to allow it to move through the sediment; feature: anterior groove **OR** depression at the anterior reason: to allow particles / food towards the mouth **OR** to generate a current of water towards the mouth;	2	the identified morphological feature and reason must be in pairs for 1 mark each **ALLOW** 2 correct features for max 1 mark
		(iv)	A = chitin B = calcium carbonate or calcite	2	**ALLOW** calcareous **OR** $CaCO_3$
		(v)	Fossil B has no jaws while the regular echinoid does; Fossil B anus at the posterior **OR** on oral surface **OR** outside apical system while the regular echinoid has anus on aboral surface **OR** at the top **OR** in apical system; Fossil B has mouth not in centre of aboral surface while the regular echinoid has the mouth in the centre; Fossil B has labrum **OR** plastron **OR** subanal fasciole **OR** anterior groove while the regular echinoid does not; Fossil B has petalloid ambs while the regular echinoid has straight ambs; Fossil B has bilateral symmetry while the regular echinoid has radial **OR** five fold; Fossil B has a heart shape while the regular echinoid has round shape;	1	**ACCEPT** discussion of crinoids as ecf from 1a (i) Answers must show a clear difference between the 2 forms any 1 point

Question			Answer	Marks	Guidance
	(b)	(i)	bivalve extends foot into the sediment **OR** bivalve extends foot into the burrow; inflates the end **OR** swells as blood is pumped into it **OR** swells by using blood pressure; foot contracts to pull bivalve **OR** the foot muscle is shortened to move **OR** moves by contraction of retractor muscles; the bivalve pulls itself through the sediment **OR** moves horizontally and/or vertically **OR** foot acts as an anchor in the sediment; extends foot out through gape **OR** extends foot between valves;	1	any two descriptors needed for one mark
		(ii)	using inhalant and exhalent siphons **OR** using siphons and gills;	1	
	(c)	(i)	labelled recognisable diagram of a long hinged brachiopod labelled recognisable diagram of a short hinged brachiopod labels include: pedicle valve, brachial valve, growth lines, umbo, commissure, fold and sulcus, foramen, ribs	1 1 2	**ALLOW** label marks even if drawings are weak. Hinge lines must be visible. If only one diagram drawn max 2 marks four different correct labels for 2 marks across both diagrams **DO NOT ALLOW** hinge line labels
		(ii)	open using diductor muscle **AND** close using adductors **OR** by contracting and relaxing adductor and diductor muscles **OR** close and open using adductor and diductor muscles	1	must have both for 1 mark
			Total	**20**	

Question			Answer	Marks	Guidance
2	(a)	(i)	<table><tr><th>Description</th><th>Type of Dinosaur</th></tr><tr><td>armoured with bony plates</td><td>saurischian **(ornithischian)**</td></tr><tr><td>have long S shaped necks</td><td>**(saurischian)** ornithischian</td></tr><tr><td>pubis bone points backwards</td><td>saurischian **(ornithischian)**</td></tr><tr><td>described as 'duck billed' dinosaurs</td><td>saurischian **(ornithischian)**</td></tr><tr><td>have hands with three digits</td><td>**(saurischian)** ornithischian</td></tr></table>	3	5 correct for 3 marks 4 correct for 2 marks 3 correct for 1 mark
		(ii)	*Diplodocus* **OR** *Tyrannosaurus*	1	**ALLOW** any correct named saurischian dinosaur **DO NOT ALLOW** T rex
		(iii)	Permo-Triassic boundary **OR** Triassic **OR** beginning of the Mesozoic **OR** after the Permo-Triassic extinction event	1	**ALLOW** 251 – 200 Ma
	(b)	(i)	advantage: hard outer casing **OR** shell reason: to protect from scavengers **OR** to protect the embryo **OR** to protect against desiccation **OR** prevents water loss **OR** to protect against weather advantage: porous / permeable shell **OR** outer casing reason: to allow oxygen into the shell and carbon dioxide out **OR** allow gas exchange for respiration advantage: yolk sac reason: to provide food to the embryo **OR** to provide nutrients to the embryo advantage: albumen **OR** a watery / aqueous substance within the shell reason: to prevent desiccation of the embryo **OR** to provide a watery environment for development **OR** to provide protein / food for growth advantage: had a membrane inside the shell reason: to allow gas diffusion but not osmosis	3	the morphological advantage and the reasons are needed as a pair = 1 mark max 3 pairs = 3 marks **ALLOW** to the embryo **OR** for development **OR** for growth as descriptors **ALLOW** albumin

Question			Answer	Marks	Guidance
		(ii)	low energy on land / terrestrial **OR** land area covered rapidly in sediment	1	**DO NOT ALLOW** just low energy **ALLOW** soil as indication of land
	(c)		feature: depth of footprints **OR** shape of footprints **OR** size of footprints **OR** pattern of tracks **OR** range of footprint sizes explanation: calculation of size **OR** calculation of mass of the dinosaur **OR** allow us to calculate the speed of the dinosaur **OR** allow us to work out whether bipedal or quadrupedal **OR** allow us to see if they are solitary or herd animals **OR** range of sizes suggests herd feature: presence of gastroliths **OR** stones explanation: used in herbivore stomachs to help break down vegetation feature: presence of coprolites **OR** faecal masses explanation: to identify food fragments to see what they have been eating **OR** large coprolites mean large animals **OR** reverse argument	2	1 mark for the feature and 1 for the explanation
	(d)		low oxygen / anoxic / anaerobic so that <u>bacteria</u> cannot survive (to destroy the skin) **OR** <u>bacterial</u> decay does not take place **OR** scavengers cannot survive; low energy so that currents do not move the organism after death **OR** low energy so that organism is not broken up; rapid deposition / burial so that bacteria cannot break down the skin **OR** rapid deposition / burial to protect from scavengers; dinosaur was trapped – in quicksand **OR** steep sided waterhole **OR** steep sided hole **OR** dinosaur body was desiccated where there was little decay;	2	any **two** points both the condition and the explanation are needed for 1 mark
	(e)	(i)	feathers, furcula, legs directly under body, reversed (big) toe, hollow bones, "S" shaped neck, three-toed foot, pubis pointing backward	2	any **two** 1 mark for each point: **ALLOW** wishbone instead of furcula
		(ii)	birds evolved from dinosaurs **OR** birds and *Archaeopteryx* were both evolved from dinosaurs (but may have evolved separately)	1	
			Total	**16**	

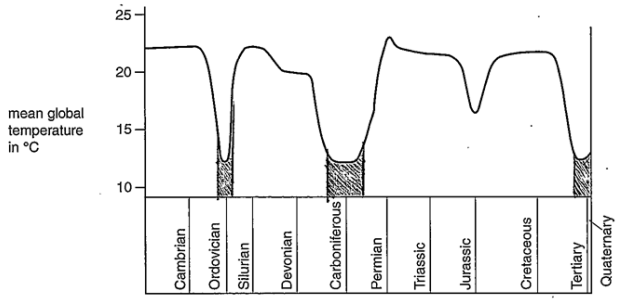
Question			Answer	Marks	Guidance
3	(a)		**half life** time taken for half of the unstable/parent isotope to decay to (stable/daughter isotope) **OR** the time taken for the radioactivity to halve **isotope** two or more forms of the same element that contain equal numbers of protons but different numbers of neutrons **OR** different isotopes of a single element occupy the same position on the periodic table **OR** any of two or more forms of a chemical element, having the same number of protons in the nucleus **OR** any of two or more forms of a chemical element having the same atomic number **OR** atoms having the same atomic number but different mass number	1 1	
	(b)	(i)	points plotted correctly at 100% – 0 Ma 50% – 50 000 Ma 25% – 100 000 Ma 12.5% – 150 000 Ma 6.25% – 200 000 Ma curve must be plotted	2	5 points plotted and curve correct for 2 marks 5 points plotted for 1 mark 3 points plotted and curve correct for 1 mark 1 or 2 points plotted correctly gains no marks
		(ii)	23 000 - 28 000 Ma	1	ecf varies from whether line or curve is drawn
		(iii)	gives a numerical answer in (millions) of years **OR** specific date given in millions of years	1	**DO NOT ALLOW** a definite age
	(c)	(i)	1 260 Ma	1	allow 1 200 to 1 300 Ma
		(ii)	muscovite mica	1	
		(iii)	oldest rocks on the diagram **OR** older than igneous intrusion Y (dyke) **OR** older than 220 Ma **OR** older than conglomerate	1	

Question			Answer	Marks	Guidance
		(iv)	look for baked margins in the sandstone at the boundary means the igneous rock is younger **OR** the absence of baked margin means that igneous rock is older; look for presence of soil / reddening / weathering on upper surface of igneous rock means that igneous rock is older **OR** the absence of soil / reddening / weathering means that igneous rock is younger; look for sandstone xenoliths in the igneous rock means igneous rock is younger;	1	any **one** point answer must include youngest or oldest and rock names in reason for one mark
		(v)	loss of daughter isotope **OR** loss of Ar gas; gives younger age than actual; loss of parent isotope by weathering / leaching; gives older age than actual; inaccuracy of equipment **OR** human error **OR** inaccuracy of half life data; causes dates to be either younger or older; problems gaining uncontaminated samples **OR** enough minerals to analyse; makes dating inaccurate; error term resulting from a series of measurements from the same sample; discusses standard deviation about the mean value	2	any point and explanation for 2 marks must be explained not described max 1 for 2 descriptions with no explanation
	(d)		labelled diagram(s) showing the law of included fragments (eg rip up clast, xenoliths, clasts) explanation of why the included fragment is older or reverse argument older rock eroded and fragments redeposited in younger rock; older country rock included in younger magma / intrusion	1 1	the included fragment must be labelled for the mark

Question			Answer	Marks	Guidance
	(e)		Joly assumed that all the water in the oceans was once fresh water; the salt had been added as rocks eroded **OR** added by rivers; salts became dissolved in rivers and streams; he calculated how much salt was in the oceans in total; he calculated average salt run off per year in rivers; he divided the amount of salt in the ocean by how much was added per year;	2	any **two** points
	(f)	(i)	biostratigraphy **OR** biostratigraphic correlation	1	
		(ii)	**correlation** correlation using microfossils can be matched between different areas; some microfossils are specific to certain environments so can be used to correlate environments; correlation can be done on first appearance, range, extinction of microfossils; used in exploration for oil or gas to match / correlate layers; **dating** specific microfossils give the age of the rock; microfossils are used as zone fossils; same microfossils found in different areas are the same age;	1 1	any **one** point any **one** point **ALLOW** detailed description of zone fossil
			Total	**19**	

Question			Answer	Marks	Guidance
4	(a)	(i)	**D** group = coral / rugose distinguishing feature any one from: dissepiments **OR** 6 major septa **OR** 6 cycles of septa **OR** columella **OR** horn shaped (corallum) **E** group = belemnite / cephalopod distinguishing feature any one from: guard **OR** calcite crystals radiating from centre **F** group = crinoid / crinoidea distinguishing feature any one from: stem **OR** ossicles	1 1 1	must have group name and distinguishing feature for one mark **OR** total of group name and distinguishing feature 6 correct for 3 marks 5 or 4 correct for 2 marks 3 or 2 correct for 1 mark
		(ii)	1: septum **OR** septa 2: dissepiments	1	both features must be correct for 1 mark
		(iii)	shallow seas **OR** shallow marine **OR** continental shelf	1	
		(iv)	fossil **E** was nektonic **OR** could swim **OR** lived in the water column so they could fall into any marine environment immediately below them	1	accept reverse argument (**ORA**) – D and F are attached to the sea floor so restricted to one environment
		(v)	filter feeder, sessile, attached to the sea floor, benthonic, epifaunal	1	any 2 of these terms combined in a description
	(b)	(i)	graptolite / graptolithinia / hemichordate / graptoloidea	1	
		(ii)	any **three** correctly labelled morphological parts from: stipe, sicula, thecae, rhabdosome	2	**ACCEPT** aperture, nema 3 correct labels = 2 marks 2 correct labels = 1 mark rhabdosome must include whole skeleton
		(iii)	scandent	1	
		(iv)	youngest H J oldest G	1	all must be in the correct order for 1 mark

Question			Answer	Marks	Guidance
	(c)		evolved rapidly so only found in narrow time zones ; widespread geographically because they are planktonic **OR** nektonic; abundant so likely to be found; easily recognisable changes so species / genera / specific forms can be identified; preservable hard parts so will be easy to find	2	any 2 if three factors given but no explanation max 1
			Total	**14**	

Question			Answer	Marks	Guidance
5	(a)		**climate** long term weather patterns over many years; meteorological conditions that prevail in a region; general conditions of the atmosphere over a large area; **weather** state of the atmosphere at a given place and time; day to day meteorological / atmospheric conditions of a particular place	1 1	
	(b)	(i)	characterised by a lack of ice sheets **OR** reduction in ice coverage and higher global temperature	1	both elements of the answer are needed for 1 mark
		(ii)	areas shaded below 15 degrees around the Ordovician – Silurian and Carboniferous - Permian and Tertiary – Quaternary boundaries  	1	need all three areas shaded but allow on periods or on or below graph

<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Marks</th><th>Guidance</th></tr>
<tr><td></td><td></td><td>(iii)</td><td>ice sheets have a high <u>albedo</u> value;
ice sheets increases the reflection of solar radiation causes the cooling of the Earth;
this forms a positive feedback thus cooling the Earth further OR processes are repeated/enhanced thus cooling the Earth further</td><td>2</td><td>any two points</td></tr>
<tr><td></td><td>(c)</td><td>(i)</td><td><table><tr><td>cycle</td><td>description</td><td>timing of cycle in years</td></tr><tr><td>eccentricity</td><td>L</td><td>Q</td></tr><tr><td>obliquity</td><td>K</td><td>N</td></tr><tr><td>precession</td><td>M</td><td>P</td></tr></table></td><td>3</td><td>5 or 6 correct = 3
3 or 4 correct = 2
1 or 2 correct = 1</td></tr>
<tr><td></td><td></td><td>(ii)</td><td>alternating sediments may reflect different temperatures in the oceans OR limestone forms in warmer conditions than clay;

higher temperature results in higher productivity / algal blooms and more carbon in the clay ORA;

change from clay to limestone occurs every 41 000 years; OR 21 000 year average;

environment changing as a result of sea level changes due to Milankovitch cycles changing temperatures;</td><td>2</td><td>any two points</td></tr>
<tr><td></td><td></td><td></td><td>Total</td><td>11</td><td></td></tr>
</table>

Question			Answer	Marks	Guidance
6			**epifaunal cemented:** feature: cement explanation: for direct attachment to rock; feature: strong / thick shell explanation: to withstand high energy currents; feature: strong adductor muscle explanation: to keep shell closed; feature: right and left valves of different sizes explanation: largest valve attached to the rock and smaller valve acts as a lid; feature: irregular shaped valves **OR** uneven growth lines explanation: has low profile on rock to maintain attachment **OR** mirroring substrate; · recognisable labelled diagram of *Ostrea* with min 2 labels	4	answers must be in pairs of morphological feature and reason **DO NOT ALLOW** strong ornament or ribs max 1 for 2 good descriptions of morphological features but no reason maximum 4 marks
			epifaunal attached: feature: <u>byssus</u> explanation: for attachment to substrate/rock **OR** flexible attachment to allow movement; feature: shell covered with periostracum layer explanation: to protect from acidic river water **OR** rain when exposed at low tide **OR** brackish water; feature: strong shell **OR** fine growth lines explanation: to protect against collision **OR** breakage **OR** to make shell streamlined to protect against strong waves / powerful tidal action / life in the littoral zone; feature: elongate shell **OR** streamlined shell explanation: to protect against collision **OR** breakage/protection in a colony **OR** to allow water to pass over smoothly **OR** they can move with the current; feature: large adductor muscles explanation: to hold the valves closed **OR** to prevent desiccation; · recognisable labelled diagram of mussel (*Mytilus*) with min 2 labels	4	answers must be in pairs of morphological feature and reason allow organic layer in place of periostracum max 1 for 2 good descriptions of morphological features but no reason maximum 4 marks

Question			Answer	Marks	Guidance
			nektonic bivalves feature: corrugated valves **OR** heavily ribbed valves **OR** thin shells with ribs explanation: gives strength without mass of a thick shell **OR** shells can be thin and strong **OR** makes shells lighter for swimming; feature: one flattened **OR** lid like valve and one curved **OR** convex valve explanation: gives a hydrofoil effect **OR** allows efficient movement through the water; feature: narrow gap between valves explanation: to keep sediment out of the shell when resting on the bottom; feature: monomyarian **OR** one large adductor muscle explanation: to allow repeated flapping of valves **OR** open and close valves rapidly **OR** strong enough for strong contractions **OR** open and close valves forcing water out and moving backwards **OR** open and close valves forcing water out for swimming; feature: has ears / wings on the hinge line explanation: to direct water currents **OR** to help stabilise the shell for swimming; feature: straight hinge explanation: improves stability; feature: numerous tiny eyes along the mantle margin explanation: to detect the movement of a predator **OR** movement away from probable predator; feature: strong ligament explanation: to open valves rapidly; · recognisable labelled diagram of scallop (*Pecten*) with min 2 labels	4	answers must be in pairs of morphological feature and reason max 1 for 2 good descriptions of morphological features but no reason maximum 4 marks max 8 with no diagrams
			Total	**10**	

Question			Answer	Marks	Guidance
7			**asteroid impact** · large (180 km) meteorite crater offshore / in Yucatan Peninsula in Mexico (Chixulub) providing mechanism for extinction **OR** global effect; · shockwave due to impact killed organisms around the site · tsunami caused by impact in the sea shown by evidence of sediments **OR** tsunami caused by impact in the sea kills organisms; · iridium layer found concentrated in layers of clay near the boundary as thought to be from space helps prove impact occurred; · shocked grains of quartz **OR** tektites found in layers close to the boundary (close to site) evidence of extreme stresses due to impact; **asteroid impact and volcanic activity** · impact/eruption caused dust/ash to enter atmosphere which can block the sun and reduce temperature **OR** lowering global temperatures so that organisms cannot adapt rapidly enough; · impact/eruption caused dust/ash to enter atmosphere **OR** cause darkness and affect plant photosynthesis **OR** food chain; · large scale fires caused by high temperatures **OR** debris from collision **OR** vegetation catching fire next to lava flow set forests on fire which killed animals and plants · forest fires created particles in atmosphere which caused global temperature changes; **volcanic activity** · Deccan Traps are large scale lava flows and eruptions covering 500 000km^2 **OR** large area **OR** eruptions occurred quickly **OR** occurring over 30 000 years shows large scale global effect · eruptions produced lava / gas which destroyed habitats; · ash smothers / kills animals and plants close by; · emission of poisonous / toxic gases on animals and plants close by; · aerosols from volcanic gases reflect solar radiation and cause cooling; · gases caused acid rain **OR** gases cause acidification of the sea; · emission of greenhouse gases **OR** CO_2 **/** SO_2 in large quantities causing global warming (lasting millions of years) **OR** increases sea temperature;		must match each piece of evidence with a reason for extinction Max 2 for descriptions of evidence with no direct effect on extinction Max 2 for descriptions of evidence with no direct effect on extinction must match each piece of evidence with a reason for extinction Max 2 for descriptions of evidence with no direct effect on extinction
			Total	**10**	

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