OCR
Oxford Cambridge and RSA

GCE

Geology

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

Advanced GCE

Mark Scheme for June 2015

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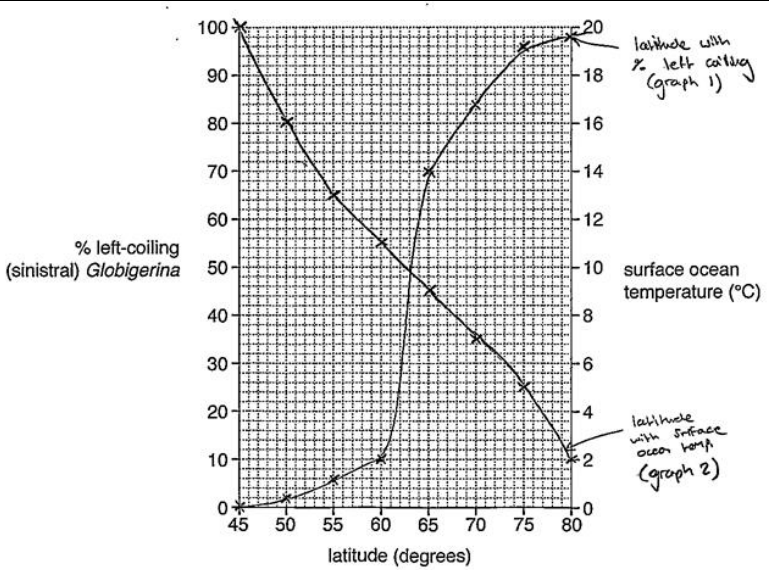
All examiners are instructed that alternative correct answers and unexpected approaches in candidates' scripts must be given marks that fairly reflect the relevant knowledge and skills demonstrated.

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.

Question			Answer/Indicative content	Mark	Guidance
1	a	i	**A** = bivalve **OR** bivalvia **B** = belemnite **OR** coleoid **C** = gastropod **D** = ammonite **OR** ceratite **OR** ammonoid	3	4 correct for 3 marks 3 correct for 2 marks 1 or 2 correct for 1 mark **ALLOW** correctly named genus or species
	a	ii	Recognisable <u>labelled</u> diagram of a gastropod with a tall spire **;** ANY three labels from: Whorl (must be bracketed), spire (must be bracketed), apex, suture, outer lip, aperture, inner lip, siphonal canal, growth lines, ornament	1 2	ecf maximum 2 marks 1 or 2 labels for 1 mark 3 labels for 2 marks **ALLOW** columella
	a	iii	ANY one from: swimming / nektonic in (shallow) waters **OR** swims by flapping its valves **;** filter feeder in (shallow) waters **OR** filter feeder in medium to high energy waters **;**	1	Must describe the mode of life with some detail for 1 mark
	a	iv	ANY one from: Fossil D lived a nektonic lifestyle and so falls out of water column into many different environments / is preserved in many different rock types**;** Fossil D was geographically widespread so found in all climate zones **OR** Fossil D was geographically widespread water depths **;** Fossil D shows rapid evolutionary changes / short stratigraphic range so has distinct forms / easily identifiable **;** Fossil D has a short stratigraphic range so has rapid evolution / distinct forms / easily identifiable ; Fossil D was abundant and so was more likely to be preserved in fossil record ;	1	Explanation must be linked to statement
	b	i	death assemblage trace fossil fossil range	2	3 correct = 2 marks 2 or 1 correct = 1 mark

Question			Answer/Indicative content	Mark	Guidance
	b	ii	ANY two from: most fossils will be fragmented **/** broken due to transport / abrasion / attrition **;** most fossils will be disarticulated due to current / wave action **;** fossils with thin / delicate shells will be rare due to transport / abrasion / attrition**;** fossils with thick / strong / heavy shells will be more common as they can withstand transport / abrasion / attrition**;** fossils with ribbed shells will be more common as they can withstand transport / abrasion / attrition**;** fossils may be aligned indicating a current ; fossils may be sorted indicating winnowing / small fragments removed by a current ; fossils are not found in life position as they are moved by the current ; fossils may not be identifiable if the sediment size is coarse **;**	2	Explanation for each point
	c	i	ANY two from: resin secreted from (pine) tree **;** insect lands on resin **OR** is engulfed by resin **OR** covered by resin **OR** trapped in resin **;** resin hardens preserving insect in amber **;**	2	
	c	ii	ANY two from: water accumulates on top of the tar / hydrocarbons **;** mammals go to drink / predators attracted to prey and become trapped in tar **;** tar is antiseptic / anoxic so they are preserved **;**	2	
			Total	**16**	

Question			Answer/Indicative content	Mark	Guidance
2	a	i	% left coiling *Globigerina* plotted against latitude **;** ocean temperature plotted against latitude **;** both lines drawn **AND** labels / key used **;**	1 1 1	 Lines must be labelled for maximum marks **ALLOW** incorrect plotting of one point per line for maximum marks
	a	ii	temperature = 10^{o}C **AND** latitude = any value between 62 and 64^{o}	1	ecf from graph in a(i) take readings using plotted graph
	a	iii	ANY one from: <u>% left-coiling Globigerina graph</u> *Globigerina* switch coiling direction at a set latitude **;** % of left coiling increases as latitude increases **;** ORA <u>Surface ocean temperature graph</u> *Globigerina* switch coiling direction at a set temperature **;** temperature increases with decrease in latitude **OR** ocean temperature decreases towards the poles **;** ORA	1 1	

Question			Answer/Indicative content	Mark	Guidance
	b	i	average rate = 2.25 per thousand years 2.25/1000 = 0.00225 cm per year 0.0225 **OR** 0.023 mm per year	1	**ALLOW** correct answer with no working
	b	ii	(deep sea) ooze **OR** (*Globigerina*) ooze **OR** pelagic ooze**;**	1	
	c	i	eccentricity **;**	1	
	c	ii	ANY two from: large peaks reflect changes in the Earth's orbit **;** orbit (is more elliptical) results in a cycle of about 100Ka **;** peaks show increase in right coiling (dextral) *Neogloboquadrina a*nd therefore increase in temperature **;** peaks are where Earth is closest to the Sun **;** ORA minor cycles may be obliquity at 41Ka or precession at 20Ka **;**	2	
			Total	**11**	

<table>
<tr><th colspan="3">Question</th><th>Answer/Indicative content</th><th>Mark</th><th>Guidance</th></tr>
<tr><td>3</td><td>a</td><td>i</td><td>
<table>
<tr><th>Feature</th><th>Rugose</th><th>Scleractinian</th><th>Tabulate</th></tr>
<tr><td>tabulae</td><td>✓</td><td>✓</td><td>✓</td></tr>
<tr><td>columella</td><td>✓</td><td>(✓sometimes)</td><td></td></tr>
<tr><td>Many septa at six points radially</td><td></td><td>✓</td><td></td></tr>
<tr><td>Many small corallites</td><td>(✓sometimes)</td><td>✓</td><td>✓</td></tr>
</table>
</td><td>4</td><td>1 mark per row

responses marked (✓sometimes) in table may be absent or marked with a tick for full marks</td></tr>
<tr><td></td><td>a</td><td>ii</td><td>Any correctly labelled morphological features from:

columella / axial structure, major septa, minor septa, dissepiments, corallite, bilateral symmetry, corallum</td><td>3</td><td>3 correct for 3 marks
2 correct for 2 marks
1 correct for 1 mark
ALLOW septa without major or minor (for one label)</td></tr>
<tr><td></td><td>b</td><td></td><td>protection from predators OR protection from high energy OR protection from currents OR skeletal support OR support of corallites in corallum ;</td><td>1</td><td></td></tr>
<tr><td></td><td>c</td><td></td><td><u>High energy conditions</u>
More oxygen incorporated into water for corals to respire / growth OR more upwelling particles for feeding / growth OR more nutrients brought in for feeding / growth ;

<u>Shallow water conditions</u>
(In photic zone) for symbiotic algae to be able to photosynthesise OR surface water temperatures are warmer for corals to grow OR surface water temperatures are warmer for chemical reactions to occur (eg enzymes) ;</td><td>1

1</td><td>Must have explanation to gain mark

Max 1 for both conditions correctly described with no explanation</td></tr>
<tr><td></td><td>d</td><td>i</td><td>crinoids die and fall to the sea bed OR crinoids get broken during storms and accumulate on the sea bed OR when crinoids die soft tissue decays and the calcite skeleton breaks up OR skeleton separates into ossicles and plates on death ;

precipitation of fine limestone (micrite) from seawater around fossils OR microfossils accumulate as a fine mud around fossils OR precipitation of cement in voids OR diagenesis occurs OR burial / compaction described ;</td><td>1

1</td><td></td></tr>
</table>

Question			Answer/Indicative content	Mark	Guidance
	d	ii	ANY two from: chalk largely composed of coccoliths **OR** chalk largely composed of microfossils **;** conditions optimum for massive blooms of microfossils to thrive **;** skeletons made of calcium carbonate (plates) **;** gradual accumulation of microfossils on sea floor over time **;** microfossils are cemented by calcite during diagenesis **;** may be formed in quiet / calm / low energy waters **OR** formed where there is no clastic / terrestrial sediment ;	2	
			Total	**14**	

Question			Answer/Indicative content	Mark	Guidance
4	a	i	<u>Cambrian specific points</u> Cambrian explosion saw the emergence of hard body parts **OR** bias in the fossil record meant that organisms were not preserved prior to the Cambrian explosion because there were no hard parts**;** emergence of stable body plans evolved in many organisms at the same time ; emergence of body plans which do not exist today (showed experimentation); evolution of larger organisms suggests predation ; ice melting during (late) Precambrian allowed conditions for Cambrian explosion **OR** climate warming during (late) Precambrian allowed conditions for Cambrian explosion ; <u>General evolution points</u> organisms were competing with each other for resources (food, space) **;** some mutations produced a survival advantage (more offspring survived) **;** survival of the fittest meant best adapted organisms passed on genes ; adaptation to new niches meant evolution of many different forms / body plans ; selection pressures (eg competition) drive evolution ;	3	**ALLOW** 1 mark for lists of 3 points Each point must have an explanation If no explanation **ALLOW** 1 mark for 2 descriptions At least 1 Cambrian specific point is needed for full marks
	a	ii	ANY three points, with a description, from: rapid burial to protect organisms from destruction / decay **;** burial in fine sediment preserves detail ; low energy environment so there is no breakage or reworking of organisms (due to currents) **;** lack of oxygen (anaerobic/ anoxic) so there is no bacterial decay of organisms **;** lack of oxygen (anaerobic/ anoxic) so that scavengers cannot live in the environment and organisms are not eaten **;** high salinity to make environment hostile for scavengers / bacteria **;** early diagenesis / replacement means that fine detail is preserved ;	3	**ALLOW** 1 mark for lists of 3 points Each point must have an explanation

Question			Answer/Indicative content	Mark	Guidance
	a	iii	replacement **;**	1	
	b	i	Arthropods **OR** trilobites **;** ANY two from the following list: appendages (jointed legs), many legs, exoskeleton (external skeleton), segmented (hard) skeleton, antennae **;**	1 1	Two morphological features for 1 mark **ALLOW** head legs **ALLOW** cephalon, thorax and pygidium for 1 mark as an alternative to segmented skeleton
	b	ii	ANY two from: have characteristics that do not fit with modern taxonomy **;** experimental body plans that were not successful did not survive / became extinct **OR** only successful body plans survived **;** they show that the fossil record is biased / incomplete **OR** only a fraction of the organisms are preserved **;** they show from what more recent / classified fossils evolved ; may show intermediate forms in evolution **OR** shows relationship between fossils ; may show an undiscovered fossil / group not previously known to exist ; it shows more complex organisms were living earlier than first thought ; may have been misidentified from whole organisms ; indicate that ecosystems were more complex than previously thought **OR** may give us information about the environment that we previously did not know	2	explanations needed for each marking point
	c		ANY one from: the ability to burrow probably evolved at this time (start of the Cambrian) ; the evolution of organisms with resistant skins / skeletons were able to burrow **;** there were predators present as they needed protection ;	1	explanations needed for each marking point
			Total	**12**	

Question			Answer/Indicative content	Mark	Guidance
5	a	i	adductor muscle labelled on both diagrams **;** diductor muscle labelled on brachiopod **o**nly (fossil **H**)**;** ligament labelled on bivalve only (fossil **J**) **;**	1 1 1	
	a	ii	small top valve labelled on brachiopod (fossil **H**)**;**	1	
	b	i	brachiopods open their valves by contracting / using the diductor muscle **;** bivalves open their valves by relaxing / using their adductor muscles **OR** the ligament aids the shell opening **;**	1 1	1 mark describing how brachiopods open their valves 1 mark describing how bivalves open their valves
	b	ii	**bivalves** have an inhalant siphon which takes in oxygenated water **OR** gills absorb oxygen **;** **brachiopods** use a lophophore **OR** use the mantle to absorb oxygen **OR** use cilia to create inhalant and exhalent currents **;**	1 1	
	c		ANY two from: <u>Attached in turbulent waters</u> (large) pedicle opening / foramen to allow a large pedicle to protrude (for attachment) **OR** pedicle holds the brachiopod in place **;** strongly ribbed to strengthen against wave action **;** smooth streamlined shape with only growth lines to withstand wave action **;** thick valves for protection / stability / strength **OR** heavy shell for protection / stability / strength **;** zigzag margin to reduce sediment getting into valves when open **;** strong (adductor) muscles to hold shells closed **;**	2	Each point must have both description and explanation I mark for two descriptions with no explanations
			ANY two from: <u>Free lying in quiet waters</u> folded margin / sulcus (median fold) to separate currents of water entering and leaving **;**	2	Each point must have both description and explanation I mark for two descriptions with no

Question			Answer/Indicative content	Mark	Guidance
			extensions to valves (wings) to protrude out of sediment **;** flat valves with large resting area to increase the surface area to prevent sinking ; large pedicle valve and small lid like brachial valve to keep shell opening above sediment **OR** keep centre of gravity lower for stability **;** smooth **OR** weakly ribbed valves as stable as there are no strong currents ; spines to stop sinking into sediment **OR** spines to spread the mass **;** long, straight hinge line giving a wide shell to stop sinking **;**		explanations
	d	i	Labelled diagram of *Solen* / razor shell / *Mya* type bivalve (or similar) Internal diagram to show any 2 labels of: elongated / streamlined shape, pallial sinus, pallial line, small (adductor) muscle scars, (small) dentition, gape **;** External diagram to show any 2 labels of: elongated / streamlined shape, fine growth lines, thin shell, (external) ligament, gape, periostracum layer **;**	1 1	**DO NOT ALLOW** same label repeated on both diagrams Max 1 mark if diagrams are the wrong way round
	d	ii	ANY 2 from: elongate shell streamlined to allow easy movement in sediment **OR** smooth / fine growth lines to allow easy movement in sediment ; small teeth / dentition as shell does not open and close **;** gape to allow siphons and/or foot to extend out from the shell **;** pallial sinus where siphon extends from the shell **;** small adductor muscles as shell does not open and close **;** siphons to extend out of the burrow to respire / feed ; large / muscular foot for digging / moving down in a burrow ;	2	Each point must have both description and explanation I mark for two descriptions with no explanations
			Total	**16**	

Question			Answer/Indicative content	Mark	Guidance
6	a	i	Late Devonian **OR** early Carboniferous **;**	1	**ALLOW** if only Devonian or Carboniferous is given
	a	ii	ANY one from each section: <u>description</u> swim bladder is (primitive) lung **;** <u>explanation</u> enable breathing out of water **;** used to carry oxygen **OR** for gaseous exchange on land **;** allowed movement from one water source to another **;**	 1 1	
	a	iii	ANY one from each section : <u>description</u> more robust / stronger / harder / more dense bone structure **;** bone involved instead of cartilage **;** had bones like ulna / radius **OR** ulna / radius could articulate as an elbow **OR** able to flex (flexion) **;** bones in the fins evolved into digits ; <u>explanation</u> increase of strength to take weight of animal on land **OR** to spread weight **OR** to support animal **OR** for stability **OR** for movement**;**	 1 1	
	a	iv	ANY four from: four fins of lobe finned fish and four limbs of amphibians **;** both had limbs in same positions**;** both lacked claws / nails **;** skull morphology similar in both **;** both had complex teeth **;** both had a tail fin **;** both had some scales **;** both had similar arrangement of bones in leg / fin **;**	2	4 correct = 2 marks 2 correct = 1 mark

Question			Answer/Indicative content	Mark	Guidance
	b	i	ANY two features for 1 mark: <u>reptilian features</u> long tail **OR** bony tail **;** three digits (fingers) on wings **;** thumb like first digit **;** (reptilian) teeth **;** sternum was not bony **OR** sternum was not keeled **;** gastralia (belly ribs) were present **;** S-shaped neck **;** ANY two features for 1 mark: <u>avian features</u> wings **OR** elongate forelimbs **;** thin bones **OR** hollow bones **;** legs directly under the body **;** furcula **;** reversed big toe **;** backward pointing pubis ; large eye orbits ;	1 1	**ALLOW** 1 mark if 1 feature correct for both reptilian **AND** avian **DO NOT ALLOW** feathers as these are not seen in the diagram
	b	ii	ANY two features explained: allowed egg to be laid out in the open / on land ; increased strength to prevent breakage / protect embryo **;** porous allowing exchange of gases (oxygen and carbon dioxide) **;** thin shells allow hatching **;** provides protection for embryo from drying out **OR** as a container for fluid **;** shell allowed nutrient source to be contained in egg **;**	2	Each point must have both feature and explanation I mark for two features with no explanation
			Total	**11**	

Question	Answer/Indicative content	Mark	Guidance
7		10	1 mark for a list of three methods Three methods described and illustrated for maximum marks **ALLOW** a maximum of 4 marks for each method Max 7 if no diagrams are provided
	<u>Superposition</u> 1. principle means that youngest rocks overlay older ones 2. assumption is that oldest rocks are at the bottom of a sequence 3. labelled diagram to illustrate superposition with oldest and youngest clearly illustrated		**ALLOW** clear statement of oldest and youngest rock in the text
	<u>Way up structures</u> 4. desiccation cracks caused by shrinkage of clays show cracks pointing to oldest in sequence 5. rootlets grow down into the soil (bifurcate) 6. cross bedding shows steepening as rock becomes younger 7. cross beds truncate earlier ones 8. graded bedding as larger fragments settle out first 9. fossils in life position given context (eg burrows point downwards) 10. labelled diagram (s) with oldest and youngest clearly labelled to illustrate: desiccation cracks; cross bedding; rootlets; graded bedding, fossils in life position		**ALLOW** clear statement of oldest and youngest rock in the text **ALLOW** a maximum of 2 marks for diagrams for way up section
	<u>Included fragments</u> 11. fragments from an older rock found within a younger one 12. Xenoliths are fragments of country rock which have been incorporated into a magma		**ALLOW** clear statement of oldest and youngest rock in the text **ALLOW** a maximum of 2 marks for diagrams for included fragments section

Question			Answer/Indicative content	Mark	Guidance
			13. derived fossils that have been weathered out of an older rock and incorporated into a younger one 14. pebbles in conglomerate are older rocks which have been eroded and redeposited **OR** rip up clasts are older fragments incorporated into younger sediment 15. labelled diagram (s) with oldest and youngest clearly labelled to illustrate xenoliths; derived fossils; pebbles in a conglomerate **OR** rip up clasts <u>Cross cutting relationships</u> 16. younger features cross cut older features 17. faults that cut through older rocks **OR** faults that cut across an older fault 18. discordant intrusions (eg dyke) cut though older sediments / rocks 19. concordant intrusions (eg sill) are parallel to sediments may see evidence of transgression to confirm age **OR** may see evidence from baked margins to confirm age 20. unconformity is a break in sediimentation represented by a change in dip between sediments above and below the unconformity 21. labelled diagram (s) with oldest and youngest clearly labelled to illustrate: angular unconformity; an intrusion; faults		**ALLOW** clear statement of oldest and youngest rock in the text **ALLOW** a maximum of 2 marks for diagrams for cross cutting relationships section
			Total	**10**	

Question			Answer/Indicative content	Mark	Guidance
8			<u>Infaunal trilobites</u> 1. **no eyes**; eyes not needed as was not a hunter **OR** eyes not needed as it fed on sediment **OR** it did not need them as it lived in a burrow / dark 2. **eyes**; on stalks protruding out of mud 3. **large cephalon / semicircular shaped cephalon / wide cephalic fringe**; may have used to dig a burrow **OR** may have used it like a shovel **OR** helps trilobites stay stable in the sediment **OR** large surface area to prevent sinking **OR** houses feeding / filtering system 4. **pitted fringe on cephalon / cephalic fringe / pits at edge of cephalon;** used to house sensory hairs **OR** help to detect prey **OR** help to detect water currents **OR** detect chemicals **OR** detect vibrations / movement 5. **small pygidium (micropygous);** efficient shape for burrowing **OR** gives greater stability in sediment 6. **extended genal spines**; spread mass on soft substrate **OR** used as a defence 7. **few pleura / thoracic segments**; no need to enrol for defence **OR** can only partially enrol **OR** needs only a few pairs of legs **OR** needs only a few gills	Max 6	Answers must be in pairs to gain credit
			<u>Nektonic and planktonic trilobites</u> 8. **eyes on stalks OR large eyes;** to see forwards, backwards, sideways, underneath **OR** eyes to actively hunt prey **OR** eyes to scavenge for food 9. **no eyes;** as they only filter feed **OR** were not active hunters 10. **elongate, streamlined body shape OR slender lighter body**; suitable for floating or swimming in water column 11. **small size**; helps stay afloat in water column **OR** lighter so easier to float 12. **inflated glabella OR large glabella OR inflated pygidium;** filled with fat or gas for buoyancy in the water column 13. **separated pleura / thoracic segments**; increases surface area for flotation 14. **numerous pleura / thoracic segments;** had many pairs of legs for swimming **OR** many gills for respiration 15. **pleura end in spines OR large curved spines;** spines help to increase surface area for flotation **OR** spines useful defence 16. **few pleura / thoracic segments**; small for buoyancy in water column **OR** can be carried easily in the currents **OR** has fewer legs as doesn't need to swim **OR** has few gills as it lived in oxygenated surface waters	Max 6	Answers must be in pairs to gain credit Morphological feature and description must match either planktonic or nektonic forms
			Total	**10**	

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