OCR
RECOGNISING ACHIEVEMENT

GCE

Geology

Advanced GCE

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

Mark Scheme for June 2011

Oxford Cambridge and RSA Examinations

OCR (Oxford Cambridge and RSA) is a leading UK awarding body, providing a wide range of qualifications to meet the needs of pupils of all ages and abilities. OCR qualifications include AS/A Levels, Diplomas, GCSEs, OCR Nationals, Functional Skills, Key Skills, Entry Level qualifications, NVQs and vocational qualifications in areas such as IT, business, languages, teaching/training, administration and secretarial skills.

It is also responsible for developing new specifications to meet national requirements and the needs of students and teachers. OCR is a not-for-profit organisation; any surplus made is invested back into the establishment to help towards the development of qualifications and support which keep pace with the changing needs of today's society.

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.

Any enquiries about publications should be addressed to:

OCR Publications
PO Box 5050
Annesley
NOTTINGHAM
NG15 0DL

Telephone: 0870 770 6622
Facsimile: 01223 552610
E-mail: publications@ocr.org.uk

Question			Expected Answers	Marks	Additional Guidance
1	a	i	A = graptolite / graptoloid B = gastropod / gastropoda C = radiolarian / microfossil / foraminifera	1 1 1	do not allow dendroid for A for fossil C allow acritarch or pollen
		ii	1 = theca / aperture 2 = stipe / rhabdosome 3 = body chamber / aperture / last chamber	1 1 1	
		iii	**description**: planktonic / pelagic / floating in surface layers of the ocean **explanation**: small, light, hydrodynamic shape / lives in colony / no means of locomotion / some may have had floats attached / attached to floating seaweed or material / filter feeder	1 1	
		iv	helical spiral / conispiral / coiled to the right / dextral	1	
		v	benthonic / bottom dwelling / epifaunal moved around using a foot / vagrant / moved on sea floor scavenged or lived on algae / may be predator	 any 2	
	b		A carbonisation / replacement by pyrite / replacement by clay B mould and cast / replacement by named mineral / replacement by silica or calcite	1 1	 for B do not simply allow replacement Max 1 for replacement as an answer to both A and B
	c	i	recognisable diagram labels from calyx, brachia, stem, ossicles	1 any 2	 accept anal tube, pinnules, holdfast
		ii	5 fold symmetry / radial symmetry / composed of calcite plates / pore pairs	any 1	accept both have anus on top
		iii	crinoids – sessile / some swim echinoids – vagrant / walk using tube feet and spines / benthonic	any 1	must discuss both crinoids and regular echinoids accept crinoids filter feed and (regular) echinoids scavenge, graze, use jaws, or are predators
			Total	**18**	

Question			Expected Answers	Marks	Additional Guidance
2	a		infaunal benthonic / infaunal nektonic vagrant planktonic	max 4	5 correct = 4 marks 4 correct = 3 marks 3 correct = 2 marks 1 or 2 correct = 1 mark
	b	i	eroded or weathered out of rock redeposited in younger sediment usually resistant fossils, (eg Jurassic bivalves in gravels)	any 2	1 mark for stating reworked without qualification
		ii	rocks appear older than they are *ora* fossil ranges appear longer or incorrect	any 1	must have a correct statement relating to age not merely it gives a wrong age
	c	i	**description:** evolved rapidly **explanation:** so only a short (stratigraphic) range **description:** abundant **explanation:** can find enough of them to date effectively **description:** easily identifiable or recognisable **explanation:** features are obvious enough to not allow confusion between similar species **description:** found in lots of rock types / facies independent **explanation:** not restricted to one environment so able to date more than one rock type **description:** wide geographical distribution **explanation:** regardless of climate or environment / found in similar rocks in different parts of the world / correlates over large areas **description:** (commonly) well preserved / resistant hard parts **explanation:** features easily identified / not damaged eg during diagenesis **description:** maybe small in size eg microfossils **explanation:** small are less likely to be damaged / huge numbers suggest that many will be well preserved	max 3	If there are two or three descriptions with no explanations max 1 allow can date rocks in the field as an explanation for any one description for max 1 description and explanation in pairs for one mark where there is overlap eg between well preserved and easily identifiable **and** rock type and geographical distribution, description and explanation can be matched across pairs

Question			Expected Answers	Marks	Additional Guidance
		ii	trilobites / graptolites	1	
	d	i	**similarities** all bones represented in both fish and amphibians / both have humerus, radius and ulna bones / similar morphologies humerus and / or radius are the largest bones radius of similar lengths describes relationship that the ulna and radius articulates with the humerus both have digits extending from ulna and radius **differences** fish have less digit bones than amphibians (to form fin) fish have larger digit bones than amphibians radius is wider in fish and narrower in amphibian ulna small in fish and more elongate to lengthen limb in amphibian ulna and radius are similar sized in amphibians but uneven sized in fish humerus larger on amphibians, smaller in fish fish have elongate digit bones (for paddle), amphibians more squat (to bend digits) fish have fins and amphibians have toes fish have larger surface area on fins whilst amphibians have a smaller surface area (separate toes) fish have some digits fused, whilst amphibians' digits are separated	any 2 any 1 any 1	Both fish and amphibians must be compared for each difference either directly or by implication. Must not simply be a list.

Question			Expected Answers	Marks	Additional Guidance
		ii	eyelids to keep eyes moist in amphibians skull shorter in fish and more elongate in amphibians jaw rounded in fish and more pointed in amphibians tooth bearing bones less pronounced in fish than amphibians modification of parts (swim bladders) to breathe air amphibians have developed lungs (fish have gills) amphibians have a moveable neck to turn, whilst fish do not amphibians have a girdle connecting limb bones to skeleton more robust skeleton in amphibians / strengthened vertebral column development of a tongue in amphibians for sensory function / catching prey ears adapted to detect soundwaves evolution of a three chambered heart / away from single circulatory system	any 1	
			Total	**16**	

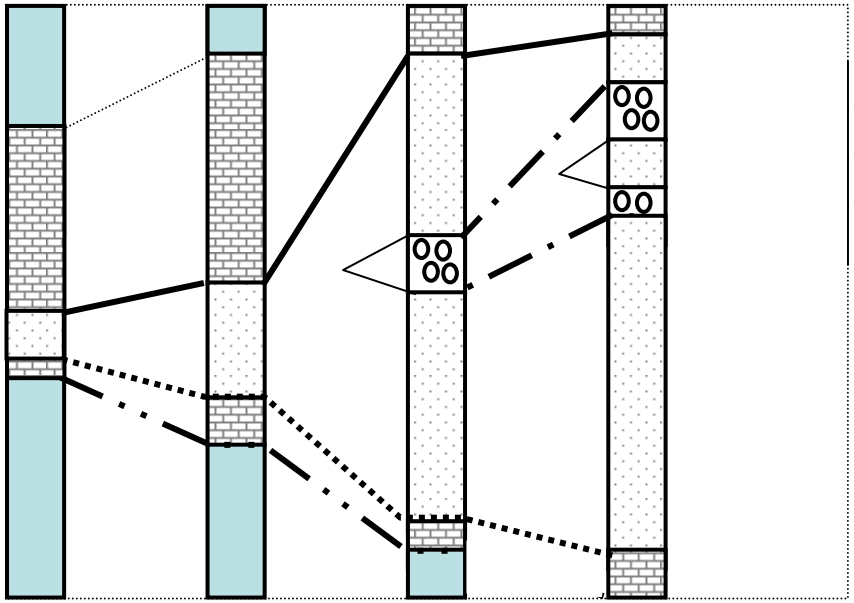
Question			Expected Answers	Marks	Additional Guidance
3	a	i	**G** **D** **J** **F**	4	1 correct = 1 mark 2 correct = 2 marks 3 correct = 3 marks 4 correct = 4 marks
	b	i	labelled diagram showing a cross cutting relationship explanation of which is older ora labelled older feature ora	1 1 1	e.g. dykes intruding other beds mark diagram as text
	c	i	1 = protoconch 2 = suture / ammonitic suture / saddle 3 = guard	1 1 1	
		ii	join the septa to the outside of the shell / delineates the chamber wall / provides strength / large attachment area / ideas of adaptation to depth	any 1	
		iii	**horizontal** jet propulsion described squirt water out of hyponome or funnel control direction / move backwards in water move using tentacles **vertical** use siphuncle to control buoyancy fluid and gas are moved between chambers	any 3	Has to be a minimum of one mark for horizontal and one mark for vertical movement 1 mark max if vertical and horizontal are described the wrong way around
		iv	septal necks point towards protoconch in nautiloids septal necks point towards aperture in ammonoids siphuncle eccentric in ammonoids siphuncle central in nautiloids or septal necks drawn and labelled the position of septal necks described siphuncle drawn and labelled the position of the siphuncle described	1 1 1 1 1 1 1 1	mark diagram as text, hence fully labelled diagrams may be awarded full marks.
			Total	**18**	

Question			Expected Answers	Marks	Additional Guidance
4	a	i	facial suture = line from glabella to margin above the compound eye, anywhere along the eye or below the eye genal spine = labelled at edge of cephalon glabella = structure in centre of cephalon	1 1 1	
		ii	pygidium forms bottom third of trilobite N	1	
		ii i	**fossil N** **description**: no eyes or small eyes **explanation**: not needed as not a predator / does not need eyes (planktonic or lived in the dark) **description**: small / few pleura / few legs / two pairs of legs **explanation**: more buoyant / easily carried by currents / independent movement difficult / didn't need many legs (planktonic) **description**: inflated glabella / large cephalon and/or pygidium **explanation**: acts as a float / buoyant as filled with fat or gas **fossil Q** **description**: many pleura **explanation**: allows enrollment for defence / walking or swimming **description**: many spines on pleura **explanation**: for protection against predators / lives where there are lots of predators / large surface area so does not sink in sediment **description**: 360^{o} vision / eyes on top of cephalon / (large) eyes / compound eyes **explanation**: for hunting / protection / lived on substrate	any 2 any 2	answers must be in pairs for description and explanation for 1 mark two descriptions only is a maximum of 1 mark
	b		many calcite plates together / many separate lenses / sees many different images of the same object	any 1	

Question			Expected Answers	Marks	Additional Guidance
	c		trilobites are extinct / lived a long time ago soft parts are not preserved / rarely preserved / only hard parts preserved many specimens are disarticulated / not found whole comparison with living organisms may be incorrect (as closest living relative is the horseshoe crab / woodlice with different way of life) discussion of characteristics of extant arthropods eg ecdysis or jointed appendages	any 2	allow alternative wording credit specific comparisons
			Total	**11**	

Question			Expected Answers	Marks	Additional Guidance
5	a	i	eccentricity	1	
		ii	when the Earth is further away from the Sun, less radiation / when the Earth is close to the Sun, more radiation / distance between Sun and surface varies orbit changes from circular to elliptical period of 100 000 years described climate effects described as less or more radiation is received (so colder or warmer) circular orbit means there is a difference in solar radiation of 6% between Jan and July / elliptical orbit means the difference is between 20% and 30%	any 3	allow *ecf* for a max of 2 marks accept relevant annotations on the diagram given
		iii	alternating sediments / sediments are bands of clays and limestones (in Jurassic rocks) changing environment described different amounts of ^{13}C in shales occurs in a 41 000 year cycle (+/- 1000 years) correlates with obliquity	any 2	
	b	i	oxygen incorporated into the $CaCO_3$ structure of the shell oxygen is in the molecular structure of the $CaCO_3$	1	
		ii	more ^{16}O trapped in ice (from precipitation as snow) more ^{18}O in sea water means lower global temperatures more ^{18}O in rocks, increased colder periods / glaciations	any 1	stretch and challenge

Question			Expected Answers	Marks	Additional Guidance
		iii	bed 6 – warm bed 5 – very cold / glacial bed 4 – cold / glacial bed 3 – very warm bed 2 – very cold / glacial bed 1 – then very cold / glacial or picking out one or more beds with low values, described as warm or interglacial picking out one or more beds with high values, described as cold or glacial picking out one or more beds in the middle, described as temperate or in-between	3 1 1 1	1 / 2 beds described correctly = 1 mark 3 / 4 beds described correctly = 2 marks 5 / 6 beds described correctly = 3 marks 1 mark maximum if cold is described as warm, and warm described as cold Allow one mark for: two main groups of shells one higher one lower in ^{18}O / global cooling or warming caused by events such as igneous activity
			Total	**11**	

Question			Expected Answers	Marks	Additional Guidance
6	a	i		max 3	1 mark = bottom of the top limestone 1 mark = top or bottom of conglomerate 1 mark = base of sandstone 1 mark = base of limestone 1 mark = top of top limestone
		ii	lithostratigraphy	1	
	b		diachronous beds – different beds laid down at the same time eg beach, sand and mud / lateral variation in facies or conditions conditions or different rates of sedimentation eg thick beds are rapid sedimentation or thin beds slow deposition beds laid down on an angle (eg delta / slope / foresets) beds faulted, folded or inverted means sequences are displaced or upside down	any 2	
			Total	**6**	

Question			Expected Answers	Marks	Additional Guidance
7			**Establish absolute ages / theory behind the method**		
			isotopes are unstable and emit radioactive particles	1	
			the parent element has formed daughter elements	1	
			describe or define the term half life	1	
			detail of half life graph	1	half life graph must have labelled axes
			explanation of how half lives are calculated using graph	1	
			measurement of daughter and parent isotopes needed / ratio found	1	
			date given in millions of years	1	
			date radioactive minerals in rocks	1	
			eg mica, sphene, zircon, hornblende, uraninite or feldspar	1	
			K^{40} decays to Ar^{40} with half life is 1,190 -1,260 Ma (+/- 100 Ma) Rb^{87} decays to Sr^{87} with half life is 50, 000 Ma (+/- 5000 Ma) U^{238} decays to Pb^{206} with half life is 4500 Ma (+/- 100 Ma) or U^{235} decays to Pb^{207} with half life 710 Ma (+/- 50 Ma)	any 2	allow two correct parent and daughter pairs eg K – Ar <u>and</u> Rb to Sr for 1 mark
				Max 7	
			Problems of radiometric dating **sedimentary**		
			problems due to loss of gases by weathering eg argon	1	a minimum of one mark needs to be gained from sedimentary, igneous and metamorphic sections for full marks
			can only date glauconite in sedimentary rocks	1	
			few minerals containing correct isotopes present in rocks	1	
			dating sedimentary rocks dates the fragments not the formation	1	
			metamorphic		
			problems due to loss of gases by weathering or metamorphism	1	
			whole rock dating / overprinting problems	1	
			metamorphism resets geological clock	1	
			igneous		
			problems due to loss of gases by weathering eg argon	1	
			problems obtaining adequate amounts of suitable minerals	1	
			large scale igneous intrusions cool slowly over time, giving a range of ages	1	

Question			Expected Answers	Marks	Additional Guidance
			applied to any of the three rock types don't know the accuracy of radiometric techniques / mass spectometer comments on margin of error for methods unknown accuracy of half lives initial amounts of isotope difficult to determine	 1 1 1 1 Max 7	
			Total	**10**	

Question			Expected Answers	Marks	Additional Guidance
8			**tar pits**		
			land deposit or waterhole	1	must get at least two points from each section (tar pits, amber and Solenhofen limestone) to warrant 10 marks
			natural oil / hydrocarbons / asphalt migrated to surface	1	
			animals or plants trapped in tar / covered in tar	1	
			attracts scavengers or predators (other animals)	1	
			antiseptic conditions / pH changes	1	
			amber		
			resin from extinct tree (terrestrial) / *Pinus succinifera* (extinct)	1	
			resin flowed down bark or tree	1	
			trapped animals / insects / plant material	1	
			preserves chitin or exoskeleton	1	
			sap / resin hardens / undergoes chemical changes	1	
			Solenhofen Limestone		
			fine grained sediment or soft carbonate muds preserves detail	1	
			original material replaced early in diagenesis	1	
			shallow sea became saline killing animals that lived or fell into it	1	
			preserved feathers of *Archaeopteryx* / well preserved *Archaeopteryx*	1	
			preserved jellyfish	1	
			conditions essential for exceptional preservation for any method		
			all encased quickly (before, during or after death)	1	
			no bacterial action / no decay / no oxygen / anaerobic conditions	1	conditions may be discussed in any method but only credited once
			no scavenging animals / no fragmentation / no transport after deposition	1	
			low energy	1	
			soft tissue preservation described	1	
			Total	**10**	

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

OCR Customer Contact Centre

14 – 19 Qualifications (General)
Telephone: 01223 553998
Facsimile: 01223 552627
Email: general.qualifications@ocr.org.uk

www.ocr.org.uk

For staff training purposes and as part of our quality assurance programme your call may be recorded or monitored

Oxford Cambridge and RSA Examinations
is a Company Limited by Guarantee
Registered in England
Registered Office; 1 Hills Road, Cambridge, CB1 2EU
Registered Company Number: 3484466
OCR is an exempt Charity

OCR (Oxford Cambridge and RSA Examinations)
Head office
Telephone: 01223 552552
Facsimile: 01223 552553