Oxford Cambridge and RSA Examinations

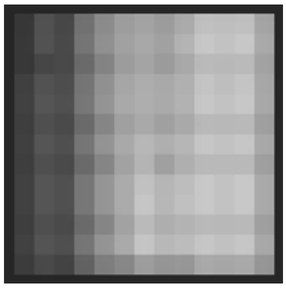
ADVANCED GCE | **A2 7884**
ADVANCED SUBSIDIARY GCE | **AS 3884**

GEOLOGY

COMBINED MARK SCHEME AND REPORT FOR THE UNITS

JANUARY 2005

AS/A2



3884/7884/MS/0R/05J

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Advanced GCE Geology (7884)

Advanced Subsidiary GCE Geology (3884)

MARK SCHEME ON THE UNITS

REPORT ON THE UNITS

Mark Scheme 2831
January 2005

Abbreviations, annotations and conventions used in the Mark Scheme	/ = alternative and acceptable answers for the marking point ; = separates marking points NOT = answers which are not worthy of credit ( ) = words which are not essential to gain credit ___ = (underlining) key words which **must** be used to gain credit ecf = error carried forward AW = alternative wording ora = or reverse argument

Question	Expected answers	Marks
1(a)	term 1 b term 2 c term 3 a term 4 d	
	3 or 4 correct = 3; 2 correct = 2; 1 correct = 1	3
(b)(i)	asymmetrical syncline	1
	symmetrical anticline	1
	if both drawn correct but labels wrong max 1	
(ii)	both axial planes drawn with plane for asymmetrical fold at an angle and for symmetrical fold vertical	1
(c)(i)	joints at crest of fold in sandstone/radial in sandstone	1
(ii)	lines parallel to fold axis in shale bed	1
(i) (ii)	Alt 1 max for correct structures in wrong bed	
(iii)	minerals rotate / realign/lined up at 90° to the maximum pressure / parallel to axial plane of fold platey minerals / clay minerals have long axes mica (muscovite) forms (by recrystallisation) caused by high pressures / compressive forces / regional metamorphism/directed stress	any 3
(d)	beds laid down horizontally / deposition of older beds	1
	beds tilted / folded / at angle	1
	erosion of older beds	1
	younger beds laid down on top	1
	max 3 without drawings max 3 without description	
(e)(i)	1 = reverse	1
	3 = tear / wrench / transcurrent / transform/strike-slip	1
(ii)	2 = tension / crustal extension	1
	3 = shear	1
		19

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			alternative wording
			or reverse argument

Question	Expected answers	Marks
2 (a)	1 shield area shield area has rocks of the same age shield areas are like a jigsaw and fit together Made of same rock types	any 2
	2 trend of fold mountains the fold mountains formed as one/ form a continuous chain jigsaw fit of the mountains Made of same rock types/age	any 2
	3 extent of (Carboniferous) polar ice sheet the ice sheet can only form near the poles as a continuous mass the striations / scratches show movement out from centre Now near the equator Jigsaw fit of the ice sheet	any 2
	4 striations Scratches formed by ice movement out Ice moves from the centre of the ice sheet/radiates Rock carried in ice scratches underlying rock	any 2
	any 2 max 4	
(b)	overlap – when rocks younger than the time of continental split form / younger than reconstruction / younger than 250 Ma/when younger rocks are deposited/deposition from deltas/rivers	1
	Gaps – when <u>erosion</u> has removed areas of rocks	1
(c) (i)	axial rift in centre shape of ridge (in cross-section) plates moving apart/convection currents magma rising/or magma chamber volcanoes in rift area/pillow lavas detail of oceanic crust normal faults/transform faults (if in plan view).	any 4
(ii)	Mid Atlantic Ridge / MOR / Mid oceanic ridge/constructive PM	1
(iii)	Magma moving up / magma pushing plates apart / Dolerite dykes intruding and pushing / igneous rocks intruding and pushing/filling spaces tensional forces/pulling apart convection currents	any 2

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(d) 2.5 cm per year 1

(e) coal 1

Desert sandstone / reef (coral) limestone / evaporates/coal (if not correct for equator) 1

Note: don't accept red sandstone but allow New Red Sandstone or Old Red Sandstone **16**

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Question	Expected answers	Marks
3(a) (i)	at constructive plate margins / mid ocean ridges / divergent margins / rift valley at destructive plate margins /the Benioff zone / continental-continental zones/subduction zone at conservative plate margin General comment along plate margins (max 1)	any 2
(ii)	due to movement along transform faults due to movement along faults at rift valley margins/along faults at conservative PM due to friction at the <u>top</u> of a subducting plate/<u>top</u> of Benioff zone/along faults in fold mountains where magma is rising	any 2
(iii)	only at destructive plate margins/at <u>depth</u> in subduction zone/<u>deeper</u> part of Benioff zone	1
(b)	subducting plate has melted / partially melted no friction/no stress building up plate is plastic rheid	any 2
(c) (i)	the magnitude of an earthquake is a measure of the amount of <u>energy</u> released/the <u>amplitude</u> of the seismic waves	1
(ii)	<u>large</u> amount of stress accumulates in rocks / build up of stress over a long time <u>large</u> amount of energy released energy released <u>close to</u> surface / **high** breaking strain / yield point / strong rocks allow intensity related answers if ecf	any 2
(iii)	buildings built to different standards ground movements magnified by weak / unconsolidated rocks epicentre in area of high population density more deaths / low population few deaths other factors such as landslides / fires hit area / lack of emergency planning/time of day (with explanation)	any 2
(iv)	base isolation systems - rubber foundations / springs / rollers to stop building moving as ground moves strong / well reinforced buildings buildings that can flex/cross-bracing counter balance weights at top of building	

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deeper/stronger foundations any 2

(d) large scale (tidal) wave in the sea caused by earthquake 1
(allow if caused by gas hydrates or large landslides)

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4	1. seismic waves	
	P waves passing through solid and liquid	1
	P waves faster in solid/slower in liquid	1
	S waves passing through solids only / not through liquids	1
	shadow zone created by outer core	1
	boundaries / discontinuities shown by changes in wave velocity	1
	Gutenberg mantle - outer core boundary where P waves slow or S waves stop/refraction/curved path in mantle due to changing properties	1
	Moho crust – mantle boundary where P or S waves speed up	1
	Outer core – inner core boundary where P waves speed up	1
	Asthenosphere has a lower P and S wave velocity as it is (5%) partially molten	
	diagrams of shadow zone fully labelled	1
	P and S waves velocity graph fully labelled	1
		max 5
	2. density	
	whole earth density is 5.5 g/cm^3	1
	crust / surface rocks density is 2.7 - 2.9 g/cm^3	1
	core density is very high >11 g/cm^3	1
	sudden change in density at Gutenberg / mantle / outer core boundary	1
	density graph	1
		max 4
	3. meteorites	
	meteorites as part of a disrupted planet	1
	stoney meteorites same material as mantle	1
	iron (nickel) meteorites same material as core	1
	(carbonaceous) chondrites represent the whole earth composition/stoney irons represent the core – mantle boundary composition	1
	magnetic field generated in liquid, iron rich outer core	1
	presence of magnetic field	1
	diagram of a magnetic field with convection in outer core	max 4

If only 1 method described allow all points up to max 6
If 3 methods described take best 2

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2 marks Answers are structured clearly and logically, so that the candidate communicates effectively, using a wide range of specialist terms with precision and spelling, punctuation and grammar are accurate.

1 mark There are shortcomings in the structure of the answer, however, the candidate is able to communicate knowledge and ideas adequately, a limited range of specialist terms are used appropriately and spelling, punctuation and grammar are generally accurate with few errors.

0 marks There are severe shortcomings in the organisation and presentation of the answer, leading to a failure to communicate knowledge and ideas. There are significant errors in the use of language, spelling, punctuation and grammar which makes the candidate's meaning uncertain.

max 2

RECOGNISING ACHIEVEMENT

Mark Scheme 2832
January 2005

Question	Expected answers	Marks
1(a) (i)	A = Igneous / Basalt / Basic	1
	B = Sedimentary / Sandstone / Wacke	1
	C = Metamorphic / Gneiss	1
(ii)	***Large crystals (phenocrysts) in a fine (crystalline) groundmass***	1
	Two stages of cooling / Large crystals (phenocrysts) form first or forms slowly / Groundmass forms later or forms quickly	Any 1
(iii)	Shape = subrounded / Subangular	1
	Sorting = Poorly sorted / *not well sorted / mixture of large and small fragments*	1
(b)(i)	Marble = Thermal / Contact / Regional	4 = 2
	High Temperature	3 = 1
	Schist = Regional	2 = 1
	High Pressure	1 = 0
(ii)	Limestone / Chalk	1
(iii)	Shale / Mudstone / Clay / Volcanic ash / Slate	1
(iv)	Mica Garnet Quartz Feldspar Ferromagmesians / *Mafics* Kyanite Staurolite ***Chlorite***	Any 2
(c)	***Crystals become larger / coarser / increase in size***	1
(d)	era is a major unit of time eg Precambrian / Palaeozoic / Mesozoic / Cainozoic	1
	system / period is the subdivision of a era egs of systems Carboniferous *(max 1 for named era and system only)*	1 1
	geological column is all 4 eras / rocks placed in order / geological time scale	

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Question	Expected answers	Marks
2(a)(i)	1 = Dyke	1
	2 = Parasitic cone / *secondary cone*	1
	3 = Vent / Pipe / *conduit*	1
(ii)	Lower intrusion to right of vent	1
(b)(i)	F = Shield Volcano / basic / *basaltic / Hawaiian*	1
	G = Strato / Composite volcano / *intermediate / andesitic / Vesuvian / Strombolian*	1
(ii)	F = Constructive / Divergent / Hotspot / *mid ocean ridge*	1
	G = Destructive / Subduction / Oceanic-continental / Oceanic-oceanic / *island arc*	1
(iii)	Partial melting of subducted plate */ some melting of plate due to friction / some melting due to increasing of geothermal gradient with depth*	1
	Magma rises to surface / *magma melts continental crust / magma mixes and forms andesite (intermediate) rock*	1
(c)	***Topography Driven**:*	
	Extent and path of lava flows	1
	Geologists look at historical pattern taken by earlier flows / hazard mapping	1
	Lahars	1
	Geologists look at historical pattern of earlier mudflows / hazard mapping	1
	Wind Driven:	
	Blast damage	1
	Analyse of similar eruptions historically allows geologists to predict possible blast damage for possible forthcoming eruptions	1
	Ash falls	1
	Pattern of distribution of possible ash falls taking into account prevailing wind directions / hazard mapping	1
	Pyroclastic flows	1
	Historical analysis of similar eruptions allows comparisons to be made, along with monitoring prevailing wind direction / hazard mapping	1
	Surveying:	
	Tiltmeters / Seismometers	1
	Placed around known dormant / active volcano, measuring changes in ground level, often indicative of magma movement at depth which may be indicative of possible volcanic eruption / *increased seismic activity pre-event*	1
	Gas analysis	1
	Monitoring changes in gas levels may show increase in emissions and concentration prior to new event	1

	Water Levels:	1	
	Levels of water in wells are known to increase prior to new event	1	
		Any 2 + 2	
(d)	Ejection of superheated water / steam / *water heated by magma* Gas pressure builds up / *forcibly ejected* *Where groundwater is heated* In active or recently active regions	Any 2	
			16

Question	Expected answers	Marks
3 (a) (i)	area where the river meets the sea / lake / river mouth	1
	low current / no current in sea so sediment deposited / deposition greater than erosion	1
(ii)	flat topsets near to shore	1
	foresets on delta front / slope NOT vertical	1
	bottomsets offshore on continental shelf	1
	ALT *Topset, foreset, bottomset in order* *max 1*	
	Diagram with sea floor and sea level *1*	
	Bed drawn of correct thickness and angle *1*	
(iii)	Topset = Coal / Seat Earth / ganister /*coarse sandstone with organic material*	1
		1
	Bottomsets = Shales / *limestone*	1
	Foresets = (Cross bedded) sandstone	
	N.B. marks may be credited in 3(a)(ii) if labelled on diagram	
(b)(i)	H = cross bedding / current bedding / cross stratification NOT cross lamination	1
	J = graded bedding / upward fining sequence	1
(ii)	larger / coarser / heavier grains deposited first	
	finer / smaller / lighter grains deposited later as velocity / current / energy decreases	
	settling of sediment in water	
	turbidity current / submarine avalanche / density flow	any 2
(iii)	Coarser particles at base of bed, finer particles at top	1
	If bed inverted this is reversed	1
(c)(i)	cyclothem	1
(ii)	the delta builds out with sediment	
	sinks isostatically	
	sea level rises / *marine transgression*	
	returns to marine environment	
	delta switching	Any 2
		17

4. Define the rock cycle. Describe the main processes operating within it.

Rock Cycle
Cycle by which all three major rock groups can be linked 1

Surface Processes

Weathering *is the breakdown of rock in-situ* 1
Erosion *is the removal of weathered material, often modifying the sediment during the process* 1
Transport *is the mode by which weathered material is take form one place to another by actions of water, wind, ice and gravity* 1
Deposition *occurs when transporting agent loses energy and deposits its load* 1
Extrusion *igneous material (lava) that reaches the surface and then crystallizes* 1

Internal Processes:
Burial *occurs as sediment accumulates over time, oldest material is at the bottom of the sequence, becoming progressively younger towards the surface* 1
Diagenesis *processes that affect sediment after deposition* 1
Metamorphism / recrystallisation, *heat and or pressure lead to the rock changing in a solid state. This may involve recrystallisation and / or mineral alignment* 1
Partial melting, *occurs in the upper mantle or lower crust as result of the geothermal gradient crossing over the mantle melting temperature* 1
Magma accumulation / crystallisation, *rising magma cools to form igneous rock / crystallises to form igneous rock* 1
Intrusion, *igneous material that crystallizes below the surface, only evident through subsequent weathering and erosion* 1
Uplift, *any rock type can be uplifted to the surface as a result of earth movements* 1
Max 8

Processes must be described not just listed to gain mark.

If all processes are shown in correct positions on diagram / flow chart without definitions max 4

If sequence of processes are listed without definitions max 4

2 marks	Answers are structured clearly and logically, so that the candidate communicates effectively, using a wide range of specialist terms with precision and spelling, punctuation and grammar are accurate.
1 mark	There are shortcomings in the structure of the answer, however, the candidate is able to communicate knowledge and ideas adequately, a limited range of specialist terms are used appropriately and spelling, punctuation and grammar are generally accurate with few errors.
0 marks	There are severe shortcomings in the organisation and presentation of the answer, leading to a failure to communicate knowledge and ideas. There are significant errors in the use of language, spelling, punctuation and grammar which makes the candidate's meaning uncertain.

Quality of Written Communication **Max 2**

Mark Scheme 2834
January 2005

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Question	Expected answers	Marks
1 (a) (i)	A = bivalve B = gastropod C = brachiopod D = crinoid E = ammonite / ammonoid / nautiloid / *cephalopod* correct = 1 mark	Max 5
(ii)	Recognisable drawing; Labels - roots / anal tube / basals / radials/ infrabasals / arms / calyx / stem / ossicle / *pinnules / brachia / tegmen / holdfast* Allow ecf	1 Any 2
(b) (i)	Siphuncle – tube within phragmocone Guard – structure left of phragmocone Septa – division within phragmocone Phragmocone – cone shaped structure 1 correct = 1 mark	Max 4
(ii)	Soft tissue surrounding guard and / or extending towards the anterior; *shown tentacles drawn in correct position*	Any 1
(c) (i)	***Correct order*** 2, 9, 1, 1, 2, 0	1
	***Plotting* (allow for ecf)** 4 correct = 1 mark 5 or 6 correct = 2 marks	2
(ii)	Alignment of belemnites (NE / SW) / *30 to 60^o and 210 - 240^o*; In line with current / palaeocurrent direction / evidence of storm deposition / aligned at right angles to current / rolled along / *elongated so they are aligned in direction of current* Ecf with rose diagram	1 1
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Question	Expected answers	Marks
2 (a) (i)		
	Tabulate	1
	Scleractinian	1
	tabulae	1
	4	1
	4	Max 4
	septa	
	4	
	columella	
	4	
	dissepiments	
	4	
(ii)	Tabulate always colonial / *compound*; Rugose possess septa / show bilateral symmetry; Rugose have dissepiments; Rugose have a columella; Tabulate have mural pores	Any 1
(iii)	Rugose / *rugose <u>and</u> tabulate*	1
	scleractinian	1

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(b) Location A

Fossils complete / not broken / complete / high preservation potential; 1

Sheltered backreef or lagoonal / away from prevailing currents / low energy 1

Location B

Fossils fragmented / broken / incomplete / low preservation potential; 1

Exposed forereef / storm deposition / experiences prevailing currents / very high energy / fossils transported away 1

(c) Shallow water / photic zone / *clear water*;
Allows photosynthetic *algae* to photosynthesise

Low detritus/ away from rivers;
Damages coral polyps / blankets reef

Warm water / tropical conditions / approx 27^{o}C;
Corals die if temp too high or too low / low tolerance to change

marine salinity close to normal (3.5%);
low (brackish) or high (hypersaline) kill coral

High energy;
Allows upwelling of nutrients / increased O_2 levels — Any 2 pairs

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Question	Expected answers	Marks
3(a)	Fossil W	

Morphological Adaptation
Reason

Elongate valves / smooth valves
Easy movement though sediment / allows burrowing

(Large) foot
Allows burrowing / *pulls organism into sediment*

Long siphons
Allows gas exchange and / *or* feeding to occur out of the burrow — Any pair 2

Gape
Allows extension of both foot and / or siphons for burrowing
Thin shells

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Light to move through sediment / thick shells not needed for protection

Fossil X

Morphological Adaptation
Reason

Any pair 2

Inequivalve
Centre of gravity is lower for stability

Thick shelled / *heavy*
Protection in high energy conditions / *unmoved by currents*

Curved lower surface
Acts as a snowshoe effect for stability in high energy / softer sediment

Strong growth lines
Grips sediment

Any pair 2

Fossil Y

Morphological Adaptation
Reason

Thin shells */ valves*
Light to allow 'swimming'

Any pair 2

Corrugated / *ribbed* shells
To strengthen shells

Single muscle / monomyarian
To control rapid flapping of valves / AW

"Ears" or "wings'
Directing currents of water

Large surface area to weight ratio
Efficient displacement of water as valves flap

Hydrodynamic shaped shell / AW
Hydrofoil effect for ease of movement

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<u>Fossil Z</u>

Morphological Adaptation
Reason

Byssus
For attachment to substrate / *rock / hard material*

Streamlined / *unornamented*
Groups live together without impact damage / hydrodynamic

(b)(i) Recognisable diagrams 1
Bivalve shows equal sized valves (labelled);
Brachiopod shows unequal sized valves (labelled);
Bivalves show symmetry along hinge line (labelled);
Brachiopods show symmetry along a median line (labelled) Any 3

(ii) *Bivalves two muscles to open, brachiopods multiple muscles to open;*
bivalves <u>and</u> brachiopods filter feed;
through siphons (bivalve);
using a lophophore / *ciliated organ* (brachiopods);
both have inhalent and exhalent *currents;*
zigzag or folded commisure for separation of currents (*brachiopods*);
brachiopods have internal support (brachidium), bivalves don't;
Gills (bivalves)
Max 2 if no comparison Max 3

15

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Question	Expected answers		Marks
4 (a) (i)	D A B E C	1 or 2 correct = 1; 3 correct = 2; 4 correct = 3; 5 correct = 4	Max 4
(b) (i)	Way up criteria Suitable diagram showing feature such as graded bed / sole structures / cross bedding; Explains which part is oldest (one mark for diagram and one for explanation)		2
	Cross cutting relationships Suitable diagram showing feature such as a dyke; Cross cutting feature must be younger than the rock it cuts (one mark for diagram and one for explanation)		2
(ii)	Varves Seasonal sediments laid down in lakes; Counting layers allows calculation of time; *Allows correlation* (between areas / over large areas); Can be dated absolutely using carbon		Any 2
	Volcanic ash Eruptions *produce ash quickly / at one time*; Settle on land or in water / *over enormous area*; Layer represents same event / recognisable over world *by composition (bentonitie)*; Can be dated absolutely using *radiometric methods*		Any 2
(c) (i)	Fossil B Fossil A	2 correct = 1 mark	1
(ii)	Fast evolution / short time range; Numerous; Geographically widespread; High preservation potential; Easily identifiable; Inhabit more than one type of environment / facies independent		Any 2

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(iii) Lower Palaeozoic
Trilobites / graptolites 1
Mesozoic
Ammonites / *ceratites* 1

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5(a) **Graptolites / diagrams**

Diagram of pendent / two stiped form	1
Diagrams of biserial form	1
Diagrams of scandent form	1
Diagrams of uniserial form	1
Diagrams of thecae	1
Diagrams of multistiped form	1
	Max 4
Early forms from Ordovician	1
Numerous branches or 4 stipes / Generic names stated – Tetragraptus	1
Early forms uniserial	1
Reduced number of stipes later in Ordovician / *two stiped* / Didymograptus	1
Early forms pendent	1
Forms may be reclined or horizontal	1
Later forms scandent	1
Single *stiped* forms with thecae back to back / biserial	1
Mixed forms like / dicellograptus / scandent forms	1
Single row of thecae / uniserial form / Monograptus	1
Silurian age uniserial forms	1
Early thecae all simple	1
Later thecae sigmoidal / hooked / elaborate (may be on diagram)	1
Complex forms show curving or spirals	1
Changes in number of stipes due to change from benthonic to pelagic	1
Reduction in stipes reduces weight to allow floating	1
Buoyancy devices allow free floating	1
Complex thecae provide better protection for zooids	1
No diagrams at all	Max 10
	Max 12

11

Abbreviations, annotations and conventions used in the Mark Scheme	/	=	alternative and acceptable answers for the marking point
	;	=	separates marking points
	NOT	=	answers which are not worthy of credit
	( )	=	words which are not essential to gain credit
	___	=	(underlining) key words which **must** be used to gain credit
	ecf	=	error carried forward
	AW	=	alternative wording
	ora	=	or reverse argument

5 (b) **Trace fossils / general points**

Activity of organism, not the organism itself	1
May represent fossil behaviour	1
Named on the basis of shape and ornamentation / one animal may produce many trace fossils	1
	Max 3

Tracks and Trails

Tracks are traces on bedding planes / foot prints / Continuous trails formed by body travelling / *animal* at rest	1
Eg such as Cruziana / arthropod walking trail / resting traces, such as gill or leg structures / Asteriacites – star fish resting trail	1
Evidence of aerobic conditions / suitable for life on substrate (*marine*)	1
low energy / fine sediment for preservation	1
Some tracks show evidence of terrestrial environment eg some dinosaurs	1
Straight and u shaped burrows represent intertidal zone / high energy (Skolithos ichnofacies).	1
Horizontal traces or trails represent continental shelf / conditions below wave base / low energy (Cruziana ichnofacies)	1
Meandering traces represent deep marine sediments / slow sedimentation rates and very low energy (Nereites ichnofacies)	1

Burrows

Burrows for dwelling / locomotion / protection / feeding	1
Suitable diagram to illustrate burrows / eg such as Skolithos / Diplocraterion / Rhizocorallium	1
Evidence of soft substrate / *soft enough to burrow /* suitable for life within substrate	1

Abbreviations, annotations and conventions used in the Mark Scheme	/	=	alternative and acceptable answers for the marking point
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	NOT	=	answers which are not worthy of credit
	( )	=	words which are not essential to gain credit
	___	=	(underlining) key words which **must** be used to gain credit
	ecf	=	error carried forward
	AW	=	alternative wording
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Some burrows show evidence of sedimentation rate or erosion eg diplocraterion	*1*
Borings	
Structures formed such as in rock / wood	1
Suitable diagram to illustrate borings / Eg such as Teredo	1
Evidence of life within hard substrate / conditions aerobic on substrate	1
Excrement	
Faecal pellets (<10mm) / Coprolites – faecal masses (>10mm)	1
Evidence of large animals living in environment	1
Others	
Root penetration structures / impressions of roots	1
Evidence of terrestrial conditions or very shallow water fringe	1
Non – faecal pellets, regurgitation pellets from birds or reptiles	1
Evidence of large animals living in environment	1

Suitable diagrams	Max 4	
No diagrams at all	Max 10	
	Max	**12**

2 marks — Answers are structured clearly and logically, so that the candidate communicates effectively, uses a wide range of specialist terms with precision and spelling, punctuation and grammar are accurate.

1 mark — There are shortcomings in the structure of the answer, however, the candidate is able to communicate knowledge and ideas adequately, a limited range of specialist terms are used appropriately and spelling, punctuation and grammar are generally accurate with few errors.

0 marks — There are severe shortcomings in the organisation and presentation of the answer, leading to a failure to communicate knowledge and ideas. There are significant errors in the use of language, spelling, punctuation and grammar which makes the candidate's meaning uncertain.

quality of written communication max 2

Question total 25

OCR

RECOGNISING ACHIEVEMENT

REPORT ON THE UNITS
January 2005

Chief Examiner's Report

General Comments

The AS modules taken in January have a mix of AS candidates taking the unit for the first time and a smaller number of resit candidates. The only A2 unit - Palaeontology - is being taken for the first time by nearly all the candidates. The performance of candidates was good on all units with a wide range of marks on all papers. There were no questions that did not have full marks from some candidates.

Many candidates are now performing better on the topics and skills which have proved a problem in the past. In 2831 the structural geology question has regularly achieved a very low mean mark in the past but this was not the case this time with some candidates achieving full marks. The use of techniques such as plotting rose diagrams is now a skill that is well known. The standard of labelling and drawing diagrams is extremely variable ranging from excellent to unrecognisable! In order for diagrams or sketches to be given credit they must be clear - not artistic with shading or complex - but simple and technical so that the features to be labelled are clearly identifiable.

The correct use of the technical terms given in the specification is essential. General descriptions and American terms regularly cause candidates to gain lower marks. The key words used in questions such as state and describe do not cause problems but the key word explain is too often ignored and answers are purely descriptive. Any 'explain' question requires candidates to give a reason or to say why.

A problem for some candidates was reading the question carefully so that the answers matched the data required. Particularly in 2832 there were a few part questions where candidates omitted the question or did not use the data provided in the question.

2831 Global Tectonics and Geological Structures

General Comments

In general the paper provided accessible questions to the candidates with the questions becoming more difficult through the paper. There seemed to be enough time for candidates to complete the paper as very few candidates missed the extended prose question. Question 1 was mainly structural and this area often weak, gave excellent answers which is very encouraging. Question 2 was less well answered with candidates not being detailed enough about the evidence of continents being together. Knowledge of a constructive plate margin though was good. Although candidates had a sound knowledge of seismology in question 3, the detailed understanding of what causes earthquakes at varying depths was not well known. The extended prose showed a complete range of marks and differentiated well between candidates.

Comments on Individual Questions

Question 1

1) (a) Candidates tended to do very well on this question with the main area of confusion being between nappe and recumbent fold. This style of question with a term and matching definitions could turn up in any paper. Terms and definitions make useful starter activities.

(b) Candidates were generally good at drawing the symmetrical anticline and asymmetric syncline although some forgot to label them. A minority of candidates confuse synclines and anticlines so that they are drawn the opposite way round. There was some difficulty with the axial planes. Candidates tended to draw the asymmetric anticline correctly but then had a vertical axial plane which did not bisect the interlimb angle.

(c) Candidates did have difficulty with joints and cleavage in terms of which bed is competent or incompetent. Knowledge of the competency of beds is essential in order to answer this question correctly as the joints needed to be drawn in the sandstone and the cleavage in the shale. The joints needed to radiate around the hinge and the cleavage had to be drawn parallel to the axial plane. Joints were better known than cleavage.

(d) Most candidates knew about the realignment of the minerals parallel to the axial plane and at 90° to the compressive stress. Fewer candidates knew that the formation of cleavage was linked to high pressure or regional metamorphism and that it involved recrystallisation of platy clay minerals and/or micas. Even though a blank space was not given in the paper the use of small diagrams could be used to clarify the answers and was credited.

(e) Candidates generally have an excellent understanding of how angular unconformities form. The written description tended to be better than the drawings but many answers gained full marks.

(f) Most candidates recognised the reverse fault but fewer knew the tear fault. Again most knew about tensional forces for the normal fault with fewer correct answers about shear stress for the tear fault. However, many candidates gained 3/4 or 4/4.

Question 2

2) (a) Candidates did have a general understanding of the evidence for continental drift but some did not take note of the rubric and talked about evidence not on the map or within the continents. Most candidates described the jigsaw like fit of the various features in simplistic answers but did not add any detail such as the rock types, age or trends. Candidates needed to have realised that two marks were available for each piece of evidence and that explanation was required in order to get full marks.

(b) The majority of candidates knew that the overlap of continents was due to deposition of some sort and that the gaps were due to erosion. Relatively few gave examples such as the growth of deltas.

(c) Most candidates drew the correct plate margin and gained 3/4 or 4/4. A cross-section was expected though some candidates drew a plan view of the Atlantic Ocean and could still gain full marks.

About half the candidates discussed convection currents as being important in plate movement with many mentioning the rising magma pushing the plates apart. Fewer wrote about ridge push and slab pull mechanisms.

(d) The vast majority of candidates correctly worked out the rate of sea floor spreading.

(e) Candidates did have difficulty with this question mainly because they did not understand the difference between “near the equator” and “tropical". There were some strange responses which included basalt, granite, gabbro, peridotite, quartz, mica!

Teaching Tip

Matching the climatic zones of the Earth to specific rock types is important evidence to establish that countries such as Britain must have moved. Although its impossible to get a perfect match as climatic belts have varied over time the rocks do give at least a rough guide.

latitude	climatic zone	rock type
0°	equatorial	coal
10°-30°	tropical (arid)	desert sandstone / evaporites
10°-30°	tropical	reef limestone
75°-90°	glacial	tillite and striations

Question 3

3) (a) Most candidates knew that shallow earthquakes are found along the plate boundaries but few were specific about which plate margins. About half the candidates knew that deep focus earthquakes are only found at destructive plate margins. Candidates do need to be aware of the different causes of shallow, intermediate and deep focus earthquakes as part of their understanding of the pattern of global seismicity.

(b) Many candidates knew that the subducting plate was molten/partially molten at that depth but others just wrote that the whole mantle was molten/liquid without referring to the subducting plate. Good answers often explained the lack of friction as the subducting plate became partially melted and the effect of the increase in temperature due to the geothermal gradient at depth making the plate plastic.

(c) Most candidates could define magnitude although some did confuse it with intensity. though they found it difficult to give reasons why a particularly high magnitude earthquake could occur.

Teaching Tip

Shallow earthquakes are generally found at
- constructive plate margins where magma is rising at the MOR
- constructive plate margins along transform faults
- destructive plate margin at the top of the subducting plate or top of the Benioff zone just as the plate begins to subduct
- conservative plate margins along a tear fault.

Intermediate and deep earthquakes are generally found at
- a destructive plate margin lower down subducting plate or deep in the Benioff zone
- a destructive plate margin with deep seated faults where two continents collide.

High magnitude earthquakes are due to
- large amounts of stress accumulating in rocks
- a large amount of energy being released
- the energy being released close to the surface
- the rocks having a very high breaking strain

(c) Most candidates could define magnitude although some did confuse it with intensity. They found it more difficult to give reasons why a particularly high magnitude earthquake could occur. Lots of appropriate ideas were given for the differences in the death toll, though some answers were lost for not comparing the two examples or giving an explanation. Techniques to stop buildings collapsing are now very well known, and many candidates gained both marks.

(d) Knowledge of tsunamis was high though answers that just referred to a tidal wave without the origin due to an earthquake were not accepted.

Question 4

4) The question asked specifically for indirect methods for evidence for the internal structure of the core and mantle - not direct methods such as drilling holes. The specification lists three methods - using seismic, density and meteorite evidence.

About two thirds of candidates had a sound fundamental knowledge of the use of seismic waves but few were detailed enough to get full marks in this section. A surprising number did not split the core into inner and outer which made statements like about P wave velocity and shadow zones were incorrect.
P/S waves were generally well known. Almost all understood that S waves were stopped by the liquid outer core and could link this to the occurrence of a shadow zone. Weaker ones had P and S the wrong way round in terms of properties, or suggested the inner core was liquid. A significant number thought the entire mantle was liquid!

The use of diagrams to show the changes in P and S velocity between the core and mantle or showing shadow zones as a result of wave refraction improved many answers. Some excellent diagrams were produced from the very strongest candidates but others were unlabelled and very inaccurate.

The main weakness was on the second source of information with most candidates choosing meteorites but few gaining full marks on them. There were a handful of superbly detailed answers. Meteorites, well known with the most able discussing “stony irons” too. All too often though the meteorite types were not specifically explained in terms of how they are thought to relate to layers of the Earth.

About 20% of candidates used density data. They had a good knowledge of whole earth and crustal densities but few gave a figure for the core. A graph to relate the density to the layers would be useful. In order to explain the density changes it was essential to relate it to composition.

A few responses showed excellent factual recall of all the layers and discontinuities of the Earth, but then failed to explain any evidence! Evidence from the Earth’s magnetic field was used by about 5% of candidates.

Teaching Tip

Meteorites provide vital indirect evidence of the Earths interior and though not much detail needs to be known it is more than the fact that meteorites exist. Meteorites are part of a disrupted planet formed at the same time as the Earth so allow us to see material from within an Earth-like planet.

Stoney meteorites - mainly peridotite have the same material as mantle

Iron-nickel meteorites have the same material as the core

(Carbonaceous) chondrites represent the whole earth composition

2832: The Rock Cycle - Processes and Products (Written Examination)

General Comments

The examination paper this session gave a full range of results, with a large variation amongst centres, some of whom had a large proportion of very well prepared and able candidates whilst others had a majority of candidates who had little grasp of the content or use of technical and 'AS' level vocabulary. A number of candidates seem to have relied heavily on GCSE or AS level Geography knowledge and were not using the precise technical terms needed for the Geology specification and the depth of factual content that is essential.

Comments on Individual Questions

Question 1

This question led to a wide range of marks ,including several maximum scores, and was generally well answered. The marks were readily available if the specification had been followed.

1) (a) (i) This question proved to be a good start to the characteristics of rock groups and the majority of candidates were able to recognise the three rock groups from the thin section drawings. A minority of candidates incorrectly identified rock A as metamorphic where they had failed to recognise the foliation.

(ii) This part question did not ask candidates to identify the texture ,just to describe the texture present . This proved to be a real problem and only a few were able to describe large crystals (phenocrysts) within a finer grained crystalline groundmass, many simply naming the texture. Although this was correctly given ,it was not what the answer required; candidates should be encouraged to make observations before they lead into subsequent deductions or interpretations. The origin of the texture was well understood and most candidates scored well. Some weaker candidates thought that this thin section was a sedimentary rock.

(iii) Textural characteristics of B were reasonably well known but there was a lack of technical vocabulary from a number of candidates, although this was often centre based. Grain shape proved a problem with a wide range being given from angular through to rounded, the rock shown was primarily exhibiting sub-angular to sub-rounded grains. Sorting was more clearly understood although there was still a lack of correct terminology with unsorted and poorly graded often appearing in responses.

(b) (i) Types of metamorphism and temperature and pressure conditions required for metamorphism were well understood by the majority of candidates. Marble generally forms under high temperatures and low pressures found in thermal / contact metamorphic environments, although it can occur as a result of regional metamorphism when pressure is also a factor. Schist is a typical regional metamorphic rock and requires temperature for recrystallisation, coarser crystal grain size and new mineral growth, whereas the pressure leads to mineral alignment (foliation) in this case schistosity.

(ii) Most candidates were aware that limestone was the parent rock of marble.

(iii) Most candidates were able to state a parent rock for schist from a range of rocks from fine grained sedimentary rocks, through fine grained pyroclastics to low grade regionally metamorphosed rocks.

(iv) The wide choice of minerals available led to most candidates scoring two marks. Some weaker candidates used clay minerals incorrectly, as by this stage in the metamorphic event the clay minerals have changed to mica or other similar minerals.

(c) The majority of candidates knew that during metamorphism crystal grain size increases, although there was the occasional incorrect reference to rates of cooling, candidates clearly confusing metamorphic and igneous processes.

(d) The terms used in describing geological time are clearly not known by a large number if candidates. Responses were centre based and from script evidence it would seem likely that many candidates had not been learnt this section of the specification.

Teaching Tip

The use of definitions can be learnt through activities such as domino cards or loop questions.
Era: A major unit of geological time which includes periods (systems)

System: Subdivision of an era into a smaller unit of time

Geological column: Rocks placed in order of formation, the geological time scale including all eras and periods (systems)

Question 2

This question was generally well answered allowing a wide range of marks including some full marks.

(a) (i) Almost all candidates were able to name at least two of the three igneous features shown. Dyke and vent were usually recognised, the parasitic cone less so. Many candidates referred incorrectly to this feature as a parasitic vent when clearly the label was on the crater not within the volcanoes interior.

(ii) The majority of candidates had few problems labelling the transgressive sill, although a small number missed this part question out, failing to read the question properly. Candidates should be encouraged to read the questions carefully and look for mark allocations given as a guide to make sure they attempt every part question.

(b) (i) There were no problems naming the types of volcanoes, the majority of candidates referred to shield and strato (composite) volcanoes respectively.

(ii) Plate tectonic settings were clearly understood although some weaker candidates referred incorrectly to the shield volcano forming at a conservative plate boundary rather than a constructive plate boundary.

(iii) Processes leading to the formation of volcanoes at destructive plate margins were well understand although a lot of candidates wrote about melting rather than partial melting of the subducting plate. It is important candidates recognise that the subducting plate only partially melts thus giving a magma of a different composition than it was originally. Technical descriptions of the magma rising to the surface were good although there were several centre based responses that referred to magma 'forcing' its way to the surface without any explanation of why.

(c) Methods of risk analysis were not well understood; many candidates were able to name a method but were unable to explain how it could be used to predict a possible imminent eruption. Credit for this question was given to prediction methods as well as those of risk analysis as prescribed in the specification. A significant number of candidates incorrectly used seismic methods such as animal behaviour and radon gas levels ,clearly confusing volcanic and seismic methods.

Teaching Tip

Risk analysis can be taught by using a planning simulation, either using a map of a real or made up volcanic island (Vulcano or Stromboli make good examples on which to base it).

The main geological features of the island can include, parasitic cones, main crater, caldera, old lava flows, former pyroclastic flows, ash deposits, geysers, thermal springs etc. together with relevant climatic data such as prevailing wind direction, presence of snow and ice and topographic details such as river valleys. This can be easily done on an A3 sheet.

The island contains only one settlement at present, but due to the growth of tourism there is a proposal to locate a hotel and holiday village there. The task for the 'planners' is to locate the development in a relatively low risk area (using the historical data to draw an annotated risk map) and to suggest monitoring methods that could be put in place to allow the possibility of early warnings to the residents should an eruption be thought imminent (scope for tilt meters, seismographs, gas correlation spectrometers etc.) The choice of location and the monitoring should be briefly justified; to demonstrate an understanding of the usefulness of the methods employed and their link to the geology.

(d) The majority of candidates were able to simply define the term geyser although many failed to refer to superheated water or steam describing hot water only. Only the more able candidates referred to the significance of pressure in the mechanism for ejection.

Question 3

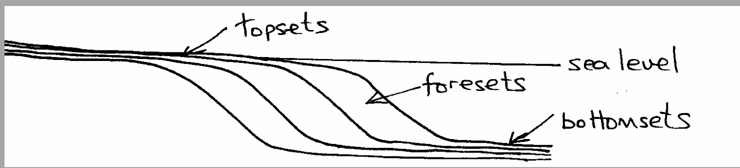
This question proved to be the most difficult on the paper with many candidates confused about deltas though knowledge of sedimentary structures was much better.

(a) (i) The definition of the term delta was quite well done with the majority knowing that deltas are found where rivers meet a sea or a lake. A few candidates stated that deltas were 'at the end of a river' without making it clear which end they meant! The idea that they formed due to flowing into a low energy environment so that the river deposits its load, or that the rate of deposition was greater than the rate of erosion, was less often stated than the location of the delta.

(ii) In this part question high quality diagrams were rare. Some candidates drew a map or plan of a delta rather than the cross section that was asked for. Others drew a vertical sequence, like the one at the beginning of the question. Mostly candidates drew only the topographic profile without any details of the beds or their relative thicknesses. Of the minority who actually drew a cross section, many did not show the foresets as being thicker than the bottomsets or put the three beds in the correct order.

Teaching Tip

Deltas are dynamic depositional environments with foreset beds deposited on top of older bottomsets as the delta progrades seawards. The thickness of the beds does need to be shown.



(ii) Although asked in the question to 'name a rock from the vertical sequence', many candidates chose to name other rocks and so made the question harder. Various alternatives were credited, but the seriously misguided metamorphic and igneous suggestions could have been avoided if those candidates had read the question a little more carefully and realised that the correct answers were printed on the paper. Weaker candidates often named the rocks in the incorrect order, following the format of topset, foreset and bottomset without reading the question carefully.

(b) (i) Virtually all candidates were able to recognise the cross bedding and graded bedding in, although a few did not use the recognised terms from the specification, 'grading' for instance.

(ii) Descriptions for the formation of the graded bedding were generally well done, although candidates should be encouraged to refer to the continuing reduction in energy to move from coarse to fine sedimentation.

(iii) In this part question some candidates began to write about structure H rather than J, careful reading of the question would have helped them to avoid this mistake. Quite a significant number were able to say where the coarse and where the fine grains should be in graded bedding, but then did not complete their explanation by saying how the way up could be determined- perhaps they thought it was obvious!

(c) (i) The response to this part question was very much centre based, with often all or none of the candidates referring to a cyclothem. A few candidates mistakenly thought that they were still supposed to be writing about graded bedding. They did not refer back to the diagram at the start of the question as intended.
(ii) Explanations of how cyclothems form varied enormously. Able candidates knew the process well ,but this part of the question did act as a good discriminator.

Question 4

This question was very well answered by the majority of candidates with a wide range of marks achieved, including numerous full marks.

The majority of candidates could describe two or three processes, include a diagram and wrote coherently. Most candidates drew a well-learnt diagram to represent the processes of the rock cycle in more or less the right places. A few did non-standard diagrams that were centred round a volcano.

Some candidates spent too long on descriptions of the various types of weathering, without always getting over the key point that it occurs in situ. Similarly there was often a lengthy description of types of metamorphism when it would have been better to move on to other processes. Some wanted to display their knowledge of types of intrusions. All these candidates would have benefited a little by moving on around the cycle rather than by concentrating too much on one process.

Erosion was often mixed in with weathering or transportation and got lost as a distinctive process. Uplift was something that just happened without a reason being given in many cases. ‘Partial melting’ was often not stated – just ‘melting’. There were very few basic lists, almost all candidates had something worthwhile to offer in terms of descriptions and they used appropriate terms, conveying their ideas clearly, so that the quality of written communication was generally high.

2834: Palaeontology (Written Examination)

General Comments

Overall, the paper is of appropriate difficulty for the A2 candidates. It is obvious that candidates were well prepared for this subject, a reflection of consistent teaching and examining over the past years. Recall of complex morphology and classification was much improved.

As usual, the quality of the diagrams produced by the candidates was variable, and both good practice and poor practice was often centre specific. There is still an issue with label lines, when candidates are required to label specific morphological features on diagrams, provided in the question.

Comments on Individual Questions

Question 1

1) (a) (i) Recognition of groups was achieved satisfactorily by almost all candidates, and show an improvement in the teaching of classification overall.

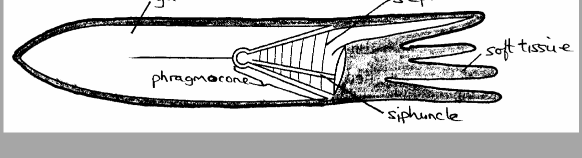
(ii) Almost all could produce recognisable and well-labelled sketches of crinoids. Many candidates completed diagrams with many more labels than they could gain marks for. Some also labelled the position of soft tissues. Where candidates had identified the fossil incorrectly in part (i) ,then error carried forward (ecf) allowed candidates to gain marks for the fossil group identified in (i).

(b) (i) Candidates were generally unsure of the basic morphology of belemnites, most did not consider the skeleton as internal. Septa and the siphuncle were better labelled, due to the similarities observed with other cephalopods. The pro-ostracum was often labelled as a guard. Very few candidates recognised what the phragmocone was, resulting in lost marks.

(ii) Most candidates recognised that the soft tissue extended from the anterior of the belemnite, and many drew tentacles and eyes on the diagram. Fewer understood that the soft tissue also extended over the guard, thus recognising the fossil as an internal skeletal part.

Teaching Tip

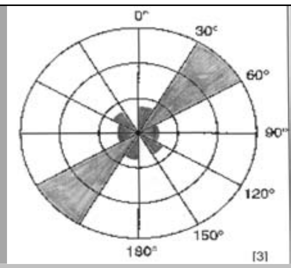
Diagrams should be labelled clearly, with the ends of the label lines touching the correct morphological part. Candidates should be taught to recognise that some morphological parts need brackets or shading, in this case, the phragmocone. The phragmocone is the area inside of the alveolus, and this part is rarely well preserved in belemnites.



(c) (i) This provided straightforward marks for careful work and most candidates were familiar with the accepted constructions of a rose diagram. The ability to decide on a sensible scale for the diagram proved to be the most common problem encountered. Some attempted to plot 000^o to 180^o separately from 181^o to 360^o, resulting in a skewed plot. These candidates may have wrongly assumed that the belemnite orientations could determine current direction.

Teaching Tip

Teachers should practise these sorts of plots, and should explain that a belemnite pointing in one orientation, is automatically pointing in the other, 180^o difference. This is the case for all linear data, unless a directional indicator is present (for example the direction of ice movement can show direction).
The plot completed correctly is shown for reference.



(ii) Most were able to recognise the trend and many gave sensible reasons to explain the distribution. However, many failed to link the distribution of the belemnites with the environment of depostion, and the presence of a current. Some described a current, and interpreted this as a river environment, rather than marine.

Question 2

2) (a) (i) Some candidates failed to read the rubric and, as a result, answered according to corals they were familiar with rather than those illustrated. A few did not know what the structures were called.

(ii) Most candidates knew significant differences between groups although a few failed to make the necessary comparison to “distinguish between” which involves some form of comparison or, at least, its implication. Some used scleractinian in the comparison and were therefore unable to gain the mark.

(iii) Most candidates knew that Scleractinian corals are extant; some did not include Rugosa as common in the Carboniferous. Most candidates gained at least one mark in this part of the question.

(b) This was fully answered by most candidates who described the relatively calm environment offered by the lagoon when compared to the wave action on the fore reef. Some candidates were sidetracked into trying to explain exceptional preservation of fossils by likening the environment to obrution deposits, such as the Burgess Shale. The commonest mistake here was to assume the fore reef environment was low energy, perhaps as a misinterpretation of the scale (B is in 20m of water). Some candidates talked about coral preservation only, despite this part being clearly labelled (b).

(c)

Conditions for coral growth are well known. There is however scope for explaining *why* these conditions support reef-building - eg photic zone for photosynthetic algae and the symbiotic relationship, or high energy to circulate oxygen and nutrients. There were too many general answers, and many failed to “describe and explain”. Instead they simply listed the conditions needed without qualification.

Teaching Tip

When this part of the specification is encountered, students should be taught to link the conditions needed with a coherent explanation.

Condition	Explanation
Shallow water in the photic zone or clear enough for light to penetrate	Allows the photosynthetic algae that are symbionts with the coral polyps, to photosynthesise
Low detritus in water column, and away from rivers	Sediments will blanket reef and prevent coral growth
Tropical water of approx 27^{o}C	Corals have low tolerance to change – a change in 3^{o}C either way could kill coral
Normal marine salinity (3.5%)	low (brackish) or high (hypersaline) kill coral
High energy conditions	Allows upwelling of nutrients and increased oxygenation of the water

Question 3

3) (a) Overall good to average students were able to access all or most of these marks, and overall this question was successfully tackled in a short answer format. However, the question proved a challenge for some candidates unable to edit their understanding into a short answer. Some did not know what a morphological adaptation was and discussed the mode of life in that column. Some failed to link their adaptation to the reason for it and risked losing marks.

Solen was well known and the adaptations well explained.

Gryphaea was well understood by some centres but others were reduced to guessing by inspection of the diagram (a commendable strategy in case of unfamiliar material). As a result many saw Gryphaea as ribbed even though they were clearly growth lines.

Pecten was understood to swim but often credited with more than one adductor muscle, the explanation of its large area to weight ratio and hydrodynamic shape were poorly explained in many cases.

Mytilus was a more familiar example and most were aware of the byssal threads and their function; there were excellent explanations of the benefits of streamlining. Guesses based on the diagram had some of the specimens walking around on the foot or, more often, pedicle.

(b) (i) There were very good, recognisable diagrams of bivalves and brachiopods showing the differences in symmetry and most candidates correctly named the valves. Occasionally the lines of symmetry were not indicated. Those few who transposed the groups got no marks.

(ii) Comparison of the feeding mechanisms revealed a variety of understandings. Reference to part (a) could have reminded candidates of bivalve siphons, most were aware of the lophophore and its supports and function in brachiopods. There was an assumption that Mytilus had no siphons, possibly because the illustrated example has its valves clamped firmly shut. The concept of inhalent and exhalent currents was not well known. Some candidates had little idea of the feeding mechanisms at all and assumed that ‘strong dentition’ meant ‘teeth for chewing’. A few candidates incorrectly discussed bivalves feeding on krill.

Question 4

4) (a) The definitions presented few difficulties.

(b) (i) Although way up criteria were known and illustrated, there were few attempts to apply this to relative ages of the rocks concerned. Some thought that there was no difference between this law and the law of included fragments or the law of superposition, thus losing marks.

Almost all candidates were able to illustrate a cross cutting relationship and explain how it worked.

Teaching Tips

The all-important 'laws' should be formally taught as definitions with given examples. For ease of recognition, these are listed below:

Law of Included Fragments	A rock contained within another rock must be older than the rock it in. For example a clay rip up clast must come from an earlier rock and so is older.
Law of Cross Cutting Relationships	Any structure that bisects another must be the younger of the two. For example a faulted dyke must mean the dyke is the oldest structure, followed by the fault.
Law of Superposition	In a vertical sequence of sedimentary or volcanic rocks, a higher rock is usually the youngest. This assumes old is down and young is up, and that they have not been overturned.
Law of Horizontality	Rock layers were originally deposited in a horizontal form. Later Earth movements must have moved them if they are no longer horizontal.
Law of Uniformitarianism	Processes operating in the past were governed by the same "laws of physics" as those that operate today. Leads to the phrase "The present is the key to the past".
Way up critera	Not a 'law' in itself, but a means of determining oldest from youngest strata, to enable the laws to be used and explained adequately. Good examples are mud cracks, and graded bedding.

(ii) Varves were obviously well understood as a depositional feature but the concept of chronostratigraphy was not. The use of ash layers was also only approached in a very general way.

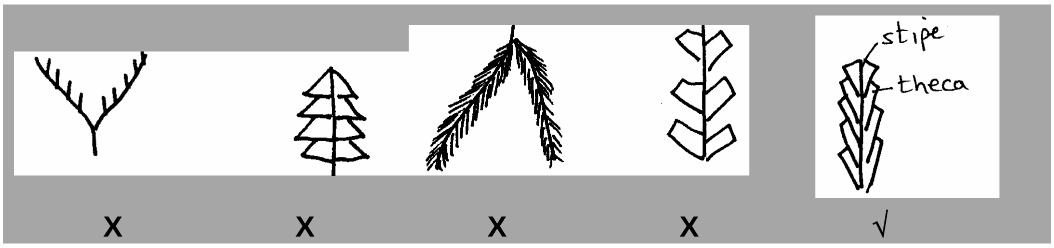
(c) (i) Most candidates were able to state the best and worst zone fossil.

(ii) Many candidates gave three or four good characteristics of a zone fossil.

(iii) Many provided names of microfossils having not completed their reading of the question. The term macrofossils is not well known. It was apparent that a good proportion of candidates were unsure of the age ranges of some of the major examinable groups. Some did not distinguish between ammonoids and ammonites, thus missing this mark. A very small proportion of candidates gave non-fossil examples such as tillite.

Question 5

5) (a) Most candidates had a good grasp of the main evolutionary trends of graptolites and many were able to use detailed examples. Some gave the evolutionary sequence backwards, from simple to complex, but described the morphology perfectly. Illustrations varied in quality and to gain marks should have been labelled. Given the high quality drawings of crinoids in Q1 ,it was surprising how vague some of the graptolite drawings were. Some examples of the stick variety, christmas tree, hairy and square are shown at the left. The correct style is on the right.



Most candidates were able to explain the trends in terms of the functionality of the changing morphology although only a few attempted to examine the reasons behind the evolution. Some assumed that as they were found shales that they lived in dark conditions, in the oceans, and that adaptations allowed deeper environments to be inhabited.

5) (b) Most candidates were able to successfully define a trace fossil and to give examples. *Cruziana* and *Rusophycus* were well represented, with many good diagrams, however these were mostly unlabelled. Only a few candidates knew of any burrowing examples.

There was the usual fascination with coprolites and the ideas that trace fossils preserve evidence of large animals fighting, or smaller animals running away from predators.

Sadly, a large majority answered the question by interpretation as to what trace fossils show us about how the animals live, or what the animals were, rather than what they tell us about the environment. Most missed the obvious point that traces of benthonic marine animals means that conditions were suitable for life on the substrate, that is aerobic with a good food supply and that preservation of tracks means a low energy environment.

The quality of written communication was generally of a good standard though spelling of technical terms is an issue.

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& Advanced GCE Geology 7884
January 2005 Assessment Session

Unit Threshold Marks

Unit		Maximum Mark	a	b	c	d	e	u
2831	Raw	60	42	37	32	28	24	0
	UMS	90	72	63	54	45	36	0
2832	Raw	60	46	41	36	31	27	0
	UMS	90	72	63	54	45	36	0
2834	Raw	90	68	61	54	47	41	0
	UMS	90	72	63	54	45	36	0

Specification Aggregation Results

Overall threshold marks in UMS (i.e. after conversion of raw marks to uniform marks)

	Maximum Mark	A	B	C	D	E	U
3884	300	240	210	180	150	120	0
7884	600	480	420	360	300	240	0

The cumulative percentage of candidates awarded each grade was as follows:

	A	B	C	D	E	U	Total Number of Candidates
3884	4.8	14.3	23.8	66.7	81.0	100	21
7884	50.0	50.0	50.0	50.0	100	100	2

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