OCR
RECOGNISING ACHIEVEMENT

GCE

Geology

Advanced GCE **A2 7884**

Advanced Subsidiary GCE **AS 3884**

Combined Mark Schemes And Report on the Units

January 2006

3884/7884/MS/R/06J

Oxford Cambridge and RSA Examinations

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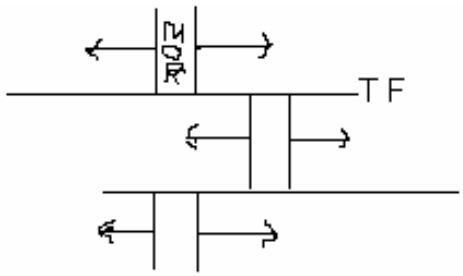
Advanced GCE Geology (7884)

Advanced Subsidiary GCE Geology (3884)

MARK SCHEMES FOR THE UNITS

REPORT ON THE UNITS

Mark Scheme 2831
January 2006

Abbreviations, annotations and conventions used in the Mark Scheme	/ = alternative and acceptable answers for the same 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 (i)	<table><tr><th></th><th>Name</th><th>Stress</th></tr><tr><td>**A**</td><td>step faults</td><td>tensional</td></tr><tr><td>**B**</td><td>horst</td><td>tensional</td></tr><tr><td>**C**</td><td>Reverse/thrust</td><td>compressional</td></tr><tr><td>**D**</td><td>Graben/rift valley</td><td>tensional</td></tr></table> 1 or 2 correct = 1 3 - 4 correct = 2 5 - 6 correct = 3 7 - 8 correct = 4 If horst and graben given for B and D max 1	**4**
(ii)	compressional = pushing together aw/shortening crust (or diag showing arrows pointing in) tensional= pulling apart/stretching crust (or diag showing arrows pointing out) if just push and pull max 1	**1** **1**
b	brittle = fault/any fault/joint/tension gashes ductile = fold/any fold/boudins/boudinage	**1** **1**
c	 MOR/constructive PM drawn and labelled Diverging arrows from MOR The fault drawn and labelled Fault with different senses of movement Fault displaces the MOR/fault at 90° to MOR and displaces it No diagram max 2 Cross-section max 1	**Any 3**

d	**(i)**	Conservative	**1**
	(ii)	Pacific to west and (North [not South]) American to east (need both)	**1**
	(iii)	Dextral	**1**
	(iv)	20 mm/yr	**1**
	(v)	150 km	**1** **Total: 16**

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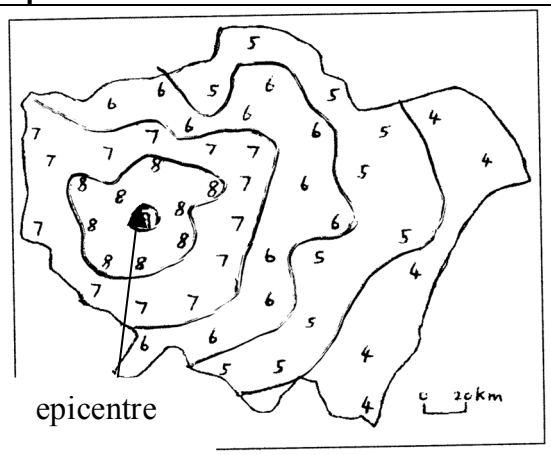
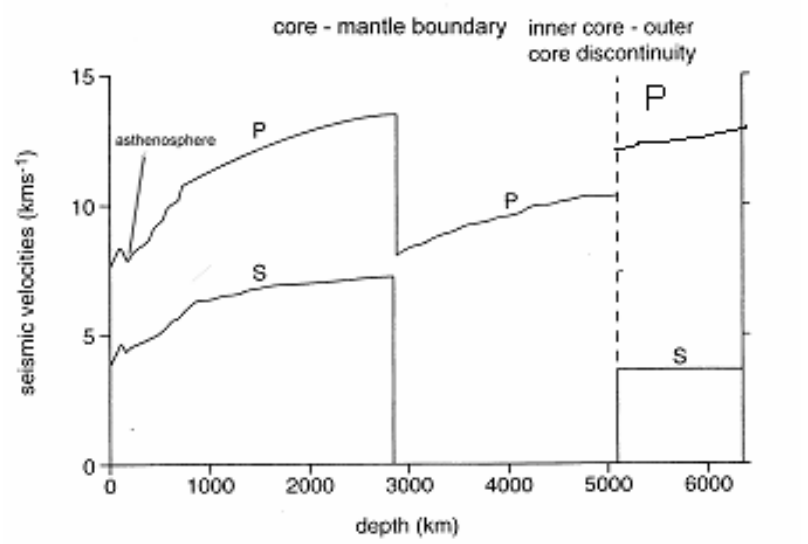
Question	**Expected Answers**	**Marks**
2 a (i)	 **(lines must be between numbers if joining the points max 1)** **1 – 2 correct = 1** **3 – 4 correct = 2** **5 correct = 3**	**3**
(ii)	**epicentre as on the map/at point 9**	**1**
(iii)	**nature of the buildings/use of earthquake proofing techniques/any appropriate technique given/population density with explanation**	**any 1**
(iv)	**technical term = island arc/volcanic arc** **plate margin = destructive/ocean v ocean collision/convergent**	**1** **1**

b (i)	the amount of energy released during an earthquake/measure of amplitude of the seismic waves	1
(ii)	based on the amount of destruction/damage caused	1
c (i)	steep slope/continental slope/mountainside unconsolidated sediment/deeply weathered clay/shale/mud unvegetated saturated ground/heavy rainfall	any 2
(ii)	liquefaction/subsidence/ground collapse/unstable ground/sinks into ground/amplifies seismic waves	1
(iii)	tsunami/tidal wave	1
d		
(i)	asthenosphere as on diagram/dip in P wave velocity/200 km depth core – mantle discontinuity as on diagram/at 2900 km	1 1
(ii)	as on diagram/velocity needs to be higher than 11 kms^{-1}	1
(iii)	as on diagram/velocity of S waves in crust/mantle lower than P waves and mimics P wave slope velocity of S waves in inner core must be lower than P wave/S wave stopping at 2900km	1 1
(iv)	on the surface of the Earth/surface waves only/do not enter the Earth/only in crust	1 [Total: 19]

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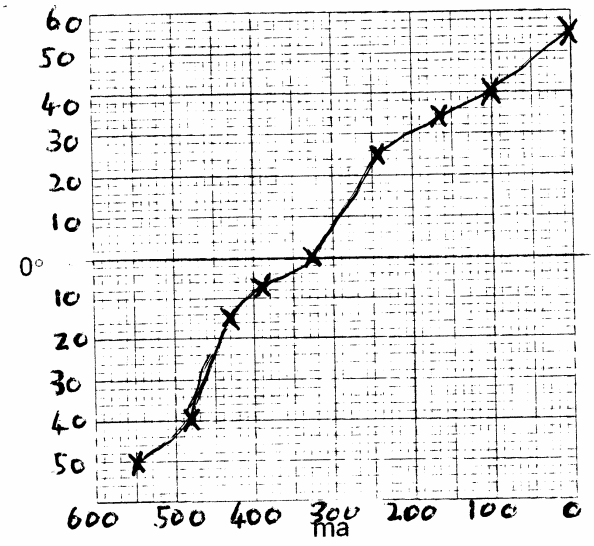
Question	**Expected Answers**	**Marks**
3 a (i)	**200 Ma**	**1**
(ii)	**where they coincide continents together/where arrows are parallel continents together** **where they diverge the continents separate** **(aw)/where arrows are different continents separate** **if just describes the arrows max 1**	**any 2**
(iii)	**igneous/basic/basalt/dolerite/gabbro/ultrabasic**	**1**
b	**sea floor spreading/MOR/slab pull/ridge push/magma (new material) rising and pushing apart** **divergent plate margin/diverging convection currents/constructive PM** **stretching crust/tension** **normal faults/graben/horst/rift valley** **may draw a labelled diagram**	**any 2**
c		

	5 – 7 correct points = 1 8 – 9 correct points = 1 curve drawn accurately (ecf)= 1 horizontal axis may be reversed	3
(ii)	480 – 430 Ma/ecf based on diagram	1
d (i)	Coal/tropical plants indicates equatorial position (Red) desert sandstone indicates desert/tropical position Glacial till/striations indicate polar position Evaporates indicates tropical Corals/reef limestone indicates tropical position Tree ring data/no tree rings equatorial	Any 2
(ii)	convection currents/earths internal heat/slab pull/ridge push/sea floor spreading	1
e (i)	area of high heat flow/rising mantle (magma) plume/volcanic activity within a plate/away from plate margin/at a fixed point relative to plate movement	1
(ii)	Hawaii/Iceland/Reunion/Azores/Etna/Stromboli/Yellowstone/Galapagos/Easter Island Any other correct example	1 Total: 15

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Question	**Expected Answers**	**Marks**
4		

Outline the evidence for sea-floor spreading.

High heat flow at Mid Ocean Ridge	**1**
mid ocean ridges/appropriate example	**1**
active volcanic zone/basic magma/pillow lavas/fissure eruptions/igneous activity	**1**
shallow earthquakes/frequent earthquakes	**1**
extension/stretching of the crust/normal faults	**1**
transform faults	**1**
positive gravity anomaly	**1**
age of sediments/rocks/crust increases with distance from ridge	**1**
thickness of sediments increases with distance from ridge	**1**
age pattern is symmetrical	**1**
points on continents either side of ocean moving apart <u>with evidence</u> from satellites	**1**
hot spot movement/sea mount movement	**1**
layered structure of the oceanic crust/layered structure of ophiolites	**1**
symmetrical magnetic anomalies (stripes) around MOR/parallel magnetic anomalies	**1**
iron particles align/reversals	**1**
fully labelled diagrams showing any of these features to be treated as text	

[Total: 8]

Quality of Written Communication

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]

[Total: 10]

Mark Scheme 2832
January 2006

Question	Expected answers	Marks
1 (a)	Regional = high and low temperature	1
	Thermal = low pressure and high and low temperature	1
	Burial = high pressure and low temperature	1

type of metamorph.	pressure		temperature	
	high	low	high	low
regional			√	√
thermal		√	√	(√)
burial	√			√

one mark per correct row

(b) (i)	A = schist/phyllite	1	
	B = gneiss	1	
	C = metaquartzite / quartzite	1	
	D = marble	1	
(ii)	A= showing sub parallel lines as mica / showing sub parallel lines as foliation / garnet crystal drawn as round / six sided / eight sided/ correct crystal size/appropriate scale.		
	Any 2 correct **or**	2	**or**
	1correct	1	
	B= showing a foliated and an unfoliated layer / quartz and or feldspar in the unfoliated layer / mica / mafic minerals in the foliated layer / shows light and dark bands/ correct crystal size/appropriate scale.		
	Any 2 correct **or**	2	**or**
	1 or 2 correct	1	
(iii)	Sedimentary rocks have fragmental texture but metamorphic rocks are crystalline AW/ grains in sedimentary rocks held together by cement but metamorphic have interlocking crystals / sedimentary rocks are not foliated but metamorphic rocks may be /sedimentary rocks have bedding but metamorphic rocks do not / have relict bedding / sedimentary rocks contain fossils but metamorphic rocks do not / contain deformed fossils.	any 2	
	One statement about sedimentary plus one about metamorphic not opposites = 1		
	Two statements about sedimentary plus two about metamorphic not opposites =2		
(c) (i)	**E =** Igneous / any named plutonic igneous rock	1	
(ii)	**F** = Hornfels	1	
(iii)	**G =** Spotted slate/rock/shale/andalusite slate/chiastolite slate	1	
	Allow rocks in progressive metamorphic sequence.		
(iv)	A region around an igneous intrusion in which the country rock has been changed/ recrystallised /altered/ by thermal metamorphism /heat/ AW.	1	
			17

Question	Expected answers	Marks	
2(a) (i)	J = basic/basaltic magma; K = non-explosive/non violent / effusive L = explosive/ violent; intermediate / andesitic /acid/rhyolitic magma		
	4 correct	3	**or**
	3 correct	2	**or**
	2 or 1 correct	1	
(ii)	They are above an upward moving part of a mantle convection cell ; rocks are fractured; steep geothermal gradient indicating magma at shallow depth ; plates diverging; magma rising to the surface; partial melting is taking place.	any 2	
(b)	**pyroclastic flows** viscous ash cloud at high temperatures/move rapidly and can vaporise all in their path; **bombs and blocks** may cause injury or death when they fall either directly or by causing roof collapse or fires; / **lava flows** may cover farmland or demolish and burn settlements; **gas** in the atmosphere may poison people / may bring about climate change / may affect crop yields ; **ash** can disrupt road and air transport / particulates in the atmosphere may bring about climate change / may affect crop yields ; **lahars** rapid mud flows may cause injury or death or destroy property	any 2	
	List of two dangers with no description	max 1	
(c)(i)	225m	1	
(ii)	N = line should be longer than the line for O / line extending between medium and coarse;	1 1	
	P = line should end at fine (allow +/- 1mm)		
(iii)	Crystal grain size is related to rate of cooling; crystal grain size is greater when cooling as been slower/ rocks are poor conductors of heat / middle of (sill) stays hotter for longer giving medium to coarse crystals ; igneous rock chilled rapidly at contact with (cold) country rock producing very fine crystals ; thicker igneous intrusions likely to have coarser crystals in the middle than less thick intrusions.	any 3	
(iv)	chilled margin should be inside the igneous rock, next to contact lines; baked margin should be inside the country rock, next to the contact lines	1 1	
(v)	has chilled margin at top and base; has baked zone above it as well as below; lack of weathered / eroded upper surface to igneous rock ; crystal grain size is too coarse for it to be extrusive;	any 2	
			17

Question	Expected answers	Marks	
3(a) (i)	5-6 points correct =	2	**or**
	3-4 points correct =	1	
	line joining up the points =	1	
(ii)	well sorted=S moderately sorted=T poorly sorted=R		
	3 correct =	2	
	1 correct =	1	
(iii)	20% is too coarse (> 2mm)	1	
(b) (i)	well rounded;	1	
	high (sphericity)/very spherical.	1	
(ii)	grains come into contact / collide during transportation; attrition occurs when grains collide / angular shapes become more rounded with attrition ; abrasion occurs when grains rub together / angular shapes become more rounded with abrasion; the longer the period of transport the more abrasion is likely to occur; the longer the period of transport the more attrition is likely to occur. the longer the period of transport the more rounded the grains.	any 2	
(iii)	wind is generally unable to transport grains larger than sand size; wind transported sediment does not contain the same range of grain sizes as water transported sediment; water generally transports a greater load than wind; water transports dissolved materials in solution; traction is when particles are moved by rolling / AW saltation is when particles are moved by bouncing /AW suspension is when particles remain permanently above the bed / AW three processes listed but not described max1	any 3	
(iv)	S	1	
(c)	lithification is a process that includes all the changes occurring in sediments / a diagenetic process occurring in loose sediment; as a result they become sedimentary rocks / they are turned into rock / turning sediments into rock; includes processes of compaction and/or cementation. compaction leads to water loss from pore spaces	any 2	
			16

4 Any **three** structures from the following:

cross bedding:
scale to show whether aeolian (m) / beach or shallow sea (10 –15 cm) / or river (3-10 cm)
surfaces are concave upwards
surfaces inclined in the direction of transport / angle<37°
sand size grains
truncation occurs at the top/migration produces new cross bedding set
transverse sections show trough cross bedding/shape of trough cross bedding related to shapes of ripple crests;
suitable diagram of structure max 3

ripple marks:
amplitude scale cm / wavelength up to 0.5m
some are symmetrical / oscillation ripple marks
some are asymmetrical /upstream side has gentle slope /downstream side has steeper slope
sand size grains max 3
they have pointed crests and rounded troughs
suitable diagram of structure

graded bedding:
heaviest / largest particles at the bottom
rip up clasts
finer particles at the top /within each layer the coarser material fines upward max 3
abrupt change in grain size at bedding plane
suitable diagram of structure

desiccation cracks:
form in mud as it contracts / AW
forming polygonal shapes seen in plan view /polygonal shapes separated by cracks
in cross section, cracks may be infilled by sand
cracks narrow downwards max 3
suitable diagram of structure
Diagrams marked as text up to overall total **8**

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 **10**

Mark Scheme 2834
January 2006

Question	Expected answers	Marks
1(a) (i)	Irregular / *a correct named irregular echinoid / Micraster*	1
(ii)	Bilateral symmetry / *A 5 fold or rayed symmetry*	1
(iii)	Anterior groove – dip /shallow part of anterior margin	1
	Plastron – posterior of the labrum (*anywhere in large dotted area)*	1
	Mouth – anterior of labrum (*between groove and labrum)*	1
(b)(i)	1 = paired pores / pores	1
	2 = interambulacral (plate)	1
(ii)	Allows protrusion of tube feet; For respiration; Attachment; Locomotion / movement; *Feeding*; Allow ecf (eg spine boss / *tubercle*)	Any 2
(c)(i)	Aristotles lantern; 5 parts to jaw structure / *strong jaws or teeth*; *Part of peristome;* Scavenging / *grazing*	Any 2
(ii)	No jaws; Mouth *positioned* in anterior / developed lip *or labrum;* *Current moves down anterior groove*; *Cilia or tube feet pass food to the mouth;* Allows easier access for particle feeding */ filter feeding /* lived in burrow	Any 2
(iii)	<u>Fasciole</u> *Supports cilia or fine spines;* Cilia */ fine spines* line fasciole; Cilia */ fine spines* beat to create currents; Remove waste from echinoid */ put waste in anal tube*	Any 2
	<u>Plastron</u> *Houses s*pecialised spines / digging spines / *larger spines*; Designed to move backwards and forwards; *Used to dig burrow / moves sediment*	Any 2
		17

Question	Expected answers	Marks
2(a) (i)	Graptolites / Hemichordata / Chordates / *graptoloidea / graptolithina*	1
(ii)	Nema – protrusion from top if fossil D	1
	Stipe – area of common canal	1
	Theca – individual cup	1
(iii)	D C E	1
(iv)	Live as colonies; Filter feeders / use common canal; Colonies *must live* in water column / planktonic / *nektonic /* swim / *AW*; Facies independent / *anywhere in the surface waters of the ocean / photic zone;*; Idea of buoyancy *mechanism or attachment*	Any 3
(b)(i)	Plants / trees / any named tree */Annularia / Lepidodendron*	1
(ii)	Low energy environment / deltaic; Marsh / bog */ swamp*; Description of cyclothem development; Rapid sedimentation / buried in fine sediments; (Plants) fall into anoxic / anaerobic environment; Low amount / no bacterial action / *minimal decay*; Preserved due to carbonisation / loss of volatiles;	Any 4
		13

Question 3(a) **Expected answers** **Marks**

Order of correct term
Cainozoic
Palaeozoic
era
biostratigraphy
period

One correct = 1 mark Max 5

(b)(i) Recognisable labelled diagram of suitable structure (e.g. cross bedding, graded bedding, sole structures, *pillow lavas, unconformities if detailed*); 1
Explanation of oldest and youngest structures, with reasons 1

(ii) Recognisable labelled diagram of geological feature (e.g. dyke); 1
Oldest features cut by younger ones ora 1

(iii) Recognisable *labelled* diagram of included fragments (e.g. conglomerate / *lava flow / derived fossils*); 1
Fragments included must be older than the surrounding rock ora 1

(c)(i) Potassium – Argon / Uranium – Lead / Rubidium – Strontium 1

(ii) Half lives *example*;
Explanation that half lives are used;
Parent atoms decay / emit particles;
Products as daughter isotopes measured;
Parent isotope measured;
Explanation of use of ratios;
Produce a *suitable labelled diagram or graph*;
Time calculable Any 3

(iii) Loss of daughter elements / loss of gas;
Weathering / erosion;
Not a closed system;
Sedimentary particles of many ages / date particles;
Radioactive / diagenetic minerals in sediments rare / glauconite Any 2

(iv) *Loss of daughter elements / loss of gas;*
Resetting of geological clock;
Introduction of foreign material into system;
Discordant dates of whole v mineral dating / blocking temperatures;
Igneous activity / fluid activity Any 2

19

Question	Expected answers	Marks
4(a)	Septal necks – may point to aperture or protoconch	1
	Siphuncle – central or eccentric	1
	Septa – boundary between chambers	1
(b)	<u>ammonitic suture</u>	
	Suitable diagram showing crenulated folds;	1
	Suitable label eg saddle, lobe, crenulation AW	1
	<u>goniatitic suture</u>	
	Suitable diagram showing smooth pattern;	1
	Suitable label eg saddle, lobe	1
		Max 3
(c)	<u>Vertical movement</u>	
	Control gas / fluid levels in chambers;	
	Movement of ions cause osmotic effects;	
	Increased gas movement upwards /More water movement downwards;	
	buoyancy controlled by movement of water in and out of chambers	Any 2
	<u>Horizontal movement</u>	
	Jet propulsion;	
	Water forced out of hyponome / *funnel*;	
	Propels animal backwards;	
	Aided by tentacles	Any 2
(d)(i)	*5 or 6 points correct = 1*	
	7 or 8 points correct = 2	2
(ii)	Mean umbilicus = 24mm / 23.6mm	1
	Mean width = 6mm / 5.8mm	1
(iii)	Falls into two groups / *positive correlation*;	1
	May be smaller due to dimorphism / males small or females large / differences due to gender;	
	Adults and juveniles;	
	Different environment of deposition / different environmental factors / *death assemblages*	Any 1
		16

5(a) **Methods of preservation**

Composition of the organism / hard v soft parts	1
Size of sediment / fine sediment fine detail	1
Sedimentation rate / fast burial	1
Scavengers / breaking up organisms	1
Bacterial action / aerobic v anaerobic	1
Energy levels / increased break up of material in high energy levels	1
Depth of water / CCD / below photic zone	1
Onset of diagenesis / early diagenesis better preservation	1
Alteration of rocks / post diagenetic changes / metamorphism	1
	Max 4
Burial in sediment / encased in something eg ice, peat etc	1
Permineralisation / recrystallisation	1
Porous skeletons become solid / often $CaCO_3$,	1
Replacement of original material	1
Calcite replaces aragonite / stability of aragonite over time	1
Carbonisation	1
Carbon films / loss of volatiles / chitin skeletons altered to carbon / plants preserved as carbon films	1
Role of heat and / or pressure	1
Silicification	1
SiO_2 deposited in skeleton / *fluids pass though skeleton*	1
Percolation of fluids	1
Pyritisation	1
Anaerobic conditions / sulphur bacteria	1
Fixation of iron / involvement of Hydrogen Sulphide	1
Cast and mould formation	1
Dissolution of fossil	1
Refilling / replacement of new material into void	1
Exceptional preservation / tar / Burgess Shale / Amber;	1
One method explained – one piece of detail	1

Mark diagrams as text No diagrams at allMax 10

Max **11**

5(b) **Burrowing bivalves**

Elongate shells	1
Development of a pallial sinus / longer siphons (eg Cytherea)	1
Rough shell surface to grip sediment / smooth shell for easier movement	1
Very deep burrowers have posterior gape / deep pallial sinus (eg Solen)	1
Live in soft substrate / shallow seas / littoral zone / *infaunal*	1
Suitable diagram showing burrowing form	1

Byssally attached

Byssus / threads made of collagen	1
Shells have byssal notch where threads emerge	1
Shells streamlined but toughened against impact (eg Mytilus / Pteria)	1
Adapted to attach to rocks in shallow seas / littoral zone / epifaunal	1
Suitable diagram showing byssally attached form	1

Cemented

Oyster larvae attach to sea floor (by left valve)	1
Extremely thick shelled forms for protection	1
Large adductor muscle to close thick shell (eg Ostrea)	1
Adapted to mainly <u>hard</u> substrates in shallow seas	1
Suitable diagram showing cemented form	1

Free lying

Convex left valve / snowshoe effect	1
Inequivalve for stability / *low centre of gravity / spines for stability*	1
Thickened shells for protection (eg Gryphaea)	1
Suitable diagram of free lying form	1

Swimming

Swim by expelling water by vigorous clapping of valves / *AW*	1
Water jets directed by ears	1
Corrugated shells for strength / thin shells for easy movement	1
Single powerful adductor only / monomyarian (eg Pecten)	1
Suitable diagram showing swimming form	1

Boring

Shell adapted (to cut rock or wood) / lined with spiny ornament	1
Mechanical boring / see saw motion of shell	1
Suitable diagram of boring form (eg Pholas or Teredo)	1

No diagrams at all Max 10

Max 12

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**

Report on the Units
January 2006

2831 Global Tectonics

General Comments

This session's examination paper was slightly easier for candidates to gain marks so that the mean mark was higher. The candidates generally performed well and there was no evidence of candidates running out of time. There was good differentiation within each question including the extended prose. There is a slight difficulty with the calculations at the end of question 1. It is interesting to note that this paper carried fewer marks for structural geology than most papers and this may account for the higher mean mark.

Comments on Individual Questions

Question 1

This question was generally well done showing a major improvement for a structural geology question with a number of candidates gaining full marks and only a few with 0 or 1.

1 **(a)** (i) Generally well done, most candidates gained 2 or 3 marks. There were a number of variations on step fault (stepping fault, even stair fault), candidates should we encouraged to use the appropriate term. Some just described the faults as normal rather than describing the whole structure shown. Candidates were generally good at identifying the stresses that formed the structures, with only the horst causing problems with many giving it as a compressional structure.

Candidates should use the terminology given in the question and spell the terms correctly rather than use other terms or even make up new ones.

(ii) Candidates did know the difference between tensional and compressional forces although a few had difficulty putting their thoughts into words. Perhaps using simple diagrams even if not asked for e.g. →← and ← would help clarify the ideas.

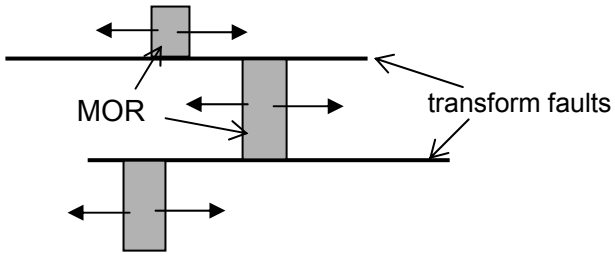
(b) This part question was not very well answered, candidates should be aware that faults are brittle structures and folds are ductile. Candidates should be aware of what the two terms mean. Some candidates discussed particular rock types in terms of competency.

Teaching Tip

Using presentations or picture cards as starter activities can help in the recognition of structures.

Ideas for illustrating brittle and ductile deformation can be done with plastic rulers. The shatterproof type is ideal for ductile deformation and the type that will break makes an excellent demonstration of brittle deformation when it reaches its breaking strength. Care does need to be taken that the fragments do not cause a danger to students! Warm and cold plasticine does the same thing but without the explosive effect.

transform faults and especially the different senses of movement along the fault. This diagram could only really be drawn as a plan view (or a block diagram) as in the example below.



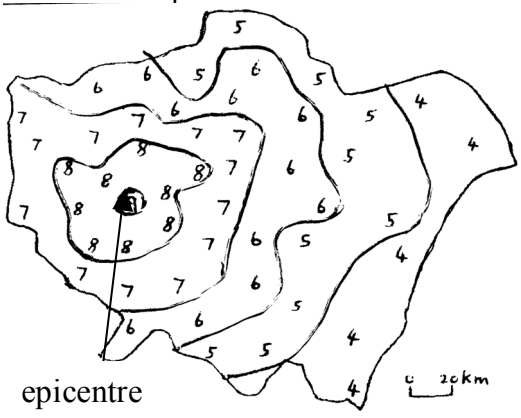
American textbooks use the term transform fault in a wider sense for all tear faults whereas we use the term transform fault only to apply to faults that cut the MOR.

(d) A relatively weak section with only about 50% of candidates realising that the San Andreas area was a conservative plate margin. A similar number knew the names of the plates involved while less knew that the fault was dextral even though the sense of movement was shown on the map. Candidates do need to be fully familiar with the technical terms used for both faults and folds.
Candidates were not good at the calculations. This type of calculation involving rates is quite common in geology papers especially 2831 and candidates should practice every variation on the theme (examples can be found in many of the 2831 past papers).

Question 2

A generally strong question with candidates answering well on this seismology based question.

2 **(a)** Again a significant minority of weaker candidates drew isoseismal lines joining the points of equal intensity rather than being half way between the points.



Candidates were very good at locating the epicentre. Most candidates understood that the nature and design of the buildings would control the amount of damage caused by the earthquake.
Relatively few candidates knew about island arcs linked to destructive plate margins with a number misspelling it as island

archs! A significant number thought that the seismically and volcanically active Indonesian islands were a hotspot.

(b) Although a straight forward question about 20% of candidates got the terms magnitude and intensity the wrong way round or completely wrong. Some still use imprecise terms such as size of earthquake for magnitude.

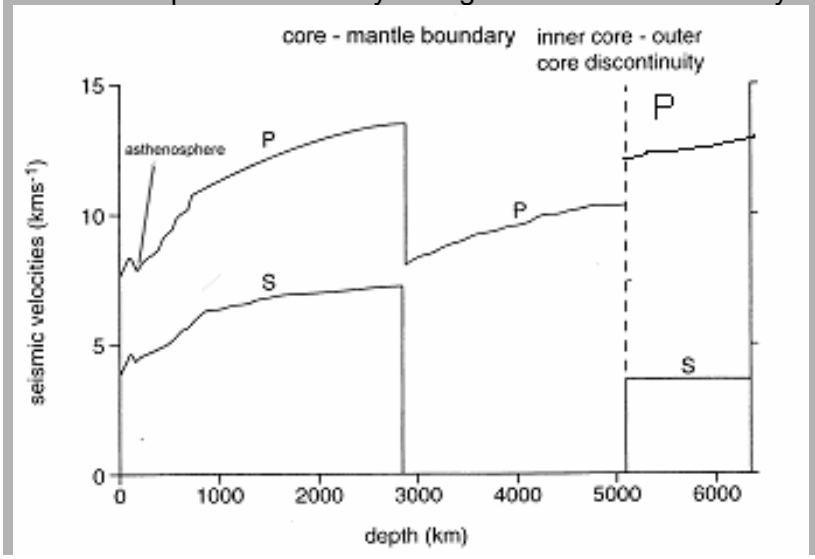
(c) (i) An impressive number of candidates were aware of what factors would make a slope unstable with very few getting 0 marks.
(ii) Most candidates knew about liquefaction although a large number did not use the term but tried to describe the phenomena instead.
(iii) A large majority of candidates knew of the tsunami hazard.

(d) This was the most difficult part of question 2 with very few getting more than 2 out of 5 marks. Proved to be a good discriminator. Particular problems were inaccurate location of the asthenosphere and no idea of the nature of the P wave discontinuity at the inner core/outer core boundary. Candidates were best at locating the core/mantle discontinuity and adding the S wave. A large majority of candidates knew that L waves are surface waves.

Teaching Tip

Candidates should be familiar with the P and S wave velocity/depth diagram. They should be able to:

- draw an approximate version for an extended prose
- add the boundaries and layers
- draw the P or S waves in the crust, mantle and core – both outer and inner
- explain the velocity changes within each of the layers



Question 3

This question was well answered with few candidates getting low marks.

3 (a) Most candidates knew the date of continental splitting but many had difficulty in explaining how they arrived at the answer. In simple terms candidates should be aware that when two polar wandering curves are parallel it suggests the continents were united and when the curves diverge than so do the continents. The majority of candidates were aware that igneous rocks were the best for palaeomagnetism although a few put granite which is not very magnetic.

(b) This did prove a difficult question with very few candidates understanding the role of normal faults/rifting and tensional forces. It is worth emphasising to candidates that they should not only know about Mid Ocean Ridges but also the initial break up of continents with the East African Rift valley being an excellent example.

(c) Candidates often achieved full marks on plotting the points and line graph. Errors included using non-linear scales and occasionally having North and South round the wrong way. Working out the times of most rapid movement was more difficult although most recognised the steeper slope between 480 and 430 Ma.

(d) (i) This question was not so well answered with a large number of candidates discussing general evidence for continental drift (jigsaw fit etc.) rather than specific evidence for Britain drifting north. Candidates needed to give both evidence and climatic zone.
(ii) Most candidates knew about the significance of convection currents, relatively few mentioned Earth's internal heat or slab pull/ridge push.

(e) The vast majority of candidates knew what a hotspot was although some had difficulty obtaining a precise enough definition. Key points are that it is a fixed point, usually within plates/away from plate boundaries, with a high heat flow resulting in volcanic activity.
Nearly all candidates knew an example usually Hawaii.

Teaching Tip

Candidates should have some examples of rock types and climatic zones for Britain to show the northward movement. Examples include:

- Coal/tropical plants indicating an equatorial position (Carboniferous)
- Red desert sandstone indicating desert/tropical position (Devonian [Old Red Sandstone] south of equator and Permian – Triassic [New Red Sandstone] north of the equator.
- Glacial till / striations indicating a polar position
- Evaporites indicating tropical positions
- Corals / reef limestone indicating a tropical position
- No tree rings in an equatorial position

Question 4

Unusually for an extended prose question there was a fairly normal distribution of marks with relatively few candidates gaining full marks. A few candidates did not answer the question.

Some candidates wrote all they knew about evidence for "continental drift" so that only some of the answer could gain marks. Sea Floor Spreading is a specific part of continental drift with most of the evidence being within the oceans.

Even the better candidates did not discuss such things as high heat flow, gravity anomalies, normal faults, rift valleys, transform faults and the symmetry of age differences and sediment thickness around Mid Ocean Ridges.

Candidates were generally very good at the symmetrical magnetic stripes, the MOR itself and the volcanic activity. Evidence of widening oceans was expected to be backed with evidence such as satellite data.

QWC was similar to past sessions although the actual legibility of writing was an issue at times.

2832: The Rock Cycle - Processes and Products

General Comments

This session's examination paper gave a wide range of results, with the usual variation between centres as much as between candidates. There were some very well prepared and able candidates, but some centres had concentrations of candidates with little grasp of the content or use of technical and 'AS' level vocabulary. These candidates seemed not to have prepared themselves adequately. A few centres showed a wide range of results amongst even a few candidates. There was no evidence that the paper could not be completed in the time allowed.

Comments on Individual Questions

Question 1

This question was the most challenging as far as the candidates were concerned and it discriminated well giving the full range of marks.

1 (a) Most candidates identified the pressure and temperature conditions associated with thermal and burial metamorphism but did not recall that regional metamorphism could occur at low as well as high temperatures.

(b) (i) Many gained full marks for successfully completing all the rock names in the flow diagram. Some either did not read the question properly or did not know the difference between metamorphic and other rock groups because they entered granite, limestone, sandstone and other inappropriate rock names.

(ii) The sketches varied in quality. The best showed that candidates had sound knowledge of what schist and gneiss should look like. Those who used the descriptions in the flow diagram to help them also gained full marks and produced capable drawings. Some drawings were not labelled even though labels are asked for in the question. Candidates need to read the questions carefully so that the drawings matched the descriptions and showed clear bands in the gneiss and included labels of the named minerals.

(iii) Quite a few candidates did not have the correct method for describing differences. Answers such as 'sedimentary rocks have fragmental texture but metamorphic rocks are crystalline' clearly states a difference, as does 'metamorphic rocks are crystalline but sedimentary rocks are not'. Both these statements have something about sedimentary and metamorphic rocks, which is really the key to successfully describing differences.

(iv) Many candidates gave a definition that repeated the question, for example 'a metamorphic aureole is an area around an intrusion which has been metamorphosed'. This kind of 'definition' just repeats the terms in the question without defining them. Some mistakenly referred to pressure as well as heating in their definitions. References to baking were not credited because a baked margin is not the same as a metamorphic aureole. Words like 'affected' do not make it clear that rocks have been altered or changed.

Teaching Tip

The 'Ten Word' definition

Students are challenged to write a definition of a geological term in ten words (or so)

- without using a dictionary
- without using the words in the term
- giving a full and complete explanation
- in good English

A metamorphic aureole comprises the rocks around an igneous intrusion altered by heat .

Question 2

This question was generally well answered. The full range of marks was awarded but the mean mark was higher than for question 1.

2 **(a)** (i) Some good responses. Occasionally there was confusion both about plate margins and the volcanic activity associated with them. Understanding the terms used to describe volcanic activity such as effusive and explosive are essential, as is the link of activity type to magma composition.
(ii) Capably done by most although some described processes at a destructive margin.

(b) Most candidates could name two dangers associated with strato volcanoes, but not everyone described the dangers. 'Volcanic gases' simply names the danger. 'Volcanic gases may poison people' contains a description of the danger. A list of two dangers without any description was given one mark.

(c) (i) Almost everyone got this right, although a few stated 4.5cm, which is not the thickness of the rock because the diagram has a scale.

(ii) The big majority successfully completed the chart. P was shown as fine and N could be shown either by drawing a line from medium to coarse, or by drawing a line longer than the one for O.

(iii) There were general answers (e.g. 'crystal grain size is related to cooling') which gained some credit, but did not refer to the igneous rock. More able candidates accounted for coarse crystal grain size by referring to insulation, or rocks being poor conductors of heat.

(iv) Well labelled and correctly identified. Very few candidates mixed up the chilled margins with the baked zones.

(v) The least well answered part of the question. Candidates quite often said that the igneous rock was intrusive just because it had rocks above and below. A considerable number were unable to suggest any proof by referring either to the chilled and baked margins or the crystal grain size.

Teaching Tip

Grain size and rate of cooling

Use two microscope slides, one at room temperature and one taken from a freezer. Using a pipette, put a few drops of liquid Salol on each slide. (Salol can be melted by using a water bath, there is no need for gas or hotplates). On which slide do crystals form first, on which slide do they grow quickest and on which slide do the largest crystals form? To use this as a group demonstration the slides can be placed on an OHP. The ideas gained can then be applied to igneous rocks, like the one in question 2.

Question 3

Apart from the essay, this question proved to be the most accessible on the paper with many candidates gaining high marks. All candidates gained at least some of the marks.

3 (a) (i) The graph was successfully plotted by virtually everyone.

(ii) Not quite the same universal success here but most gained the two marks.

(iii) Only a minority knew that 2mm is the upper grain size limit for sand and only a small proportion gained this mark. Being able to read this kind of basic information is just as useful as being able to calculate sorting coefficients.

(b) (i) Roundness terms were better known than those for sphericity. Both roundness and shape are included in the specification and both need to be known.

(ii) Candidates often gained just one mark here because they were unable to explain properly. The terms attrition and abrasion were terms used to explain changes in roundness, but some resorted to 'bumping' and 'banging into', which, whilst perhaps adding excitement, lacks the degree of precision required at this level.

(iii) Some correctly named the processes but were unable to describe them. This was especially the case with suspension.

(iv) Sediment S was usually chosen although a misguided minority favoured R, revealing some lack of awareness of the characteristics of wind transported sediments.

(c) Lithification was well known. Not everyone knew that it was sediment that became rock and there was the occasional 'turning into stone' rather than rock. This term was generally better defined than the term metamorphic aureole in question 1.

Teaching Tip

A Geological Ball Game

Ask students work in pairs. They face each other at opposite ends of a bench or table, or even on opposite sides of the room. They have a sponge ball or tennis ball which represents a grain of sediment. The challenge: how do you get the ball from one person to the other? Walking is not allowed, neither is leaning across the bench, or passing the ball on by hand – they should be far enough apart to make this impossible. Of course, the only three methods are throwing the ball (suspension), rolling it (traction) and bouncing it (saltation). By describing what they did the students are then able to clearly describe these three processes of transportation.

Question 4

This question was well answered by very many candidates. A high proportion gained maximum marks. Written communication was usually clear. Candidates appeared not to have run out of time and several answers were quite long involving generally unnecessary extra sheets of paper. This was due to these candidates not having read or interpreted the question properly.

The characteristic features of all the sedimentary structures were well described. The very best drawings were of graded bedding and desiccation cracks. Quite a few ripple marks were drawn with rounded crests and pointed troughs and so were upside down. Some ripple mark drawings did not clearly show symmetrical or asymmetrical forms with the worst being a kind of hybrid scribble. Cross bedding was the least well drawn overall. Surfaces were quite often drawn as being almost vertical and not concave upwards. Candidates seemed to be less clear as to what cross bedding looked like than they were with the other structures.

A few candidates wasted time by doing all four structures instead of the three asked for in the question. Since it is the first three that are counted there is no advantage to be gained in doing a fourth. Quite a number spent extra time and effort in enthusiastically describing how the structures were formed. The question only asked for the characteristic features to be described. There was no need to describe the mode of formation as well. Many were clearly keen to do this and these were the candidates who required the extra sheets of paper. Nevertheless, they still finished and did not appear to have been short of time.

Despite these areas for improvement the great majority of candidates demonstrated that they had learnt the characteristics of sedimentary structures well and are to be congratulated on their achievement.

2834: Palaeontology

General Comments

The standard of knowledge shown by candidates on this paper was the best yet with very few incomplete scripts. The paper was of appropriate difficulty for the A2 candidates and there was no evidence that the candidates had run out of time, as many had used extension sheets to complete their answers. Candidates were well prepared for this subject, a reflection of increased calibre of teaching and examining over the past years. Recall of complex morphology and classification was much improved and knowledge of types of preservation was excellent.

As usual, the quality of the diagrams produced by the candidates was variable, and both good practice and poor practice was often centre-specific. Some candidates drew excellent diagrams that were unlabelled while others were not accurately drawn and sometimes drawn in pen instead of pencil.

Comments on Individual Questions

Question 1

1) (a) (i) Most candidates were able to identify correctly the echinoid group as irregular. Some candidates clearly did not read the question, giving the standard answer echinoid or echinoderm, which was already stated in the question. Alternative incorrect answers included coral, mollusc and bivalve.

> **Teaching Tip**
> Candidates must realise that they will not be given credit for a repetition of part of the question. In this case the term echinoid was used in the stem of the question. One way around this is to encourage candidates to underline the technical terms in the question as they read it, thus minimising the chances of repetition later in the question.

(ii) Bilateral symmetry was well understood, although some described the shape as heart shaped or a similar descriptive term rather than answering the question.

(iii) Most candidates were able to label the anterior groove and the plastron. The position of the mouth was less certain by some candidates, with many labelling the labrum (which appears mouth like in plan view). Some indicated the position of the mouth to be central in the petaloid ambulacra. There were still some problems with the accuracy of arrows or label lines, indicating a vague part of the diagram rather than the structure required. This problem is endemic.

(b) (i) The arrow indicating morphological feature 1 on the diagram of the irregular echinoid clearly points to the pore, therefore labelling this as a plate was incorrect. The most common error was to label this as a tubercle or to state that it was 'tube feet'. Incorrect guesses bizarrely included: free cheeks; pleura; growth lines; mural pores and vesicles. Morphological feature 2 was generally answered correctly.

(ii) Most candidates were clear as to the functions of tube feet and gained full marks. A minority thought that this pore was an aperture through which gas exchange occurred directly.

(c) (i) The purpose of Aristotle's lantern and feeding on algae was well understood by most candidates. Some gave vague descriptions of excretion instead, thus not answering the question. A minority thought there was no difference between the feeding mechanisms of both regular and irregular echinoids and simply repeated the answer in (ii). Some candidates incorrectly explained the use of a lophophore, which obviously gained no marks.

(ii) Most candidates understood the tube feet as feeding mechanisms employed by irregular echinoids. Although, the cilia involvement was not often mentioned, and many seemed to think that sediment formed a major part of their diet.

(iii) *Fasciole* - This was poorly answered. Few candidates were able to state what the fasciole supports, and there were many references to 'hairs'. Some candidates were able to state waste disposal as a function.

Plastron - The function of the plastron was reasonably well understood. There were excellent descriptions of digging spines which were centre-specific. Incorrect answers centred round the plastron being used to feed the echinoid. Some thought of it as a sieve or suction device for fine sediment, or as a balance to stop sinking in soft sediment. A minority described this as a sense organ.

Question 2

2) (a) (i) Almost all candidates were able to identify the group as graptolites.

(ii) Most candidates could label the morphological features, although a frequent mistake was to label the nema and the stipe the wrong way around.

(iii) Impressively most candidates recognised the evolutionary order of the species illustrated. Some candidates even identified, named and gave the age for each fossil which was far more were asked to do.

(iv) Most candidates understood the planktonic nature of the species. A small number believed that they were benthonic, perhaps confusing them with dendroids. Some thought that fossil D had 'roots'. A minority of students thought that each different fossil had a different mode of life and tried to describe three modes of life as an answer to the question. Some talked about flapping or movement of the stipes to swim.

(b) (i) Some candidates gave very good answers, a few even named the coal measures plants correctly. Sadly most students did not correctly identify the fossil plant fragments. This would have been an easier task if they had read the stem of the question correctly as this referred to Carboniferous cyclothems. The most common incorrect answer was coral, although other incorrect answers included cephalopods, crinoids, gastropod, foraminifera, microfossils generally and ammonites.

Teaching Tip
Candidates should be encouraged to look at scales given on illustrated fossils. The idea that fossils F and G could be microfossils given the size indicated demonstrates a lack of understanding of scales.

X 1 = means that it is life size
X 10 = means it is ten times life size
X 0.5 = means that it is half life size…. etc

Try several different scale methods using bar scales and magnification scales. Practical drawing and encouragement for students to add scales to diagrams would also help here.

(ii) As the stem of the question stated that the environment was in a cyclothem, there was no error carried forward allowed for this question. Most incorrect answers therefore discussed the conditions needed for the growth of coral as this was the most common incorrect identification. A few recognised the delicate appearance of the plant remains and gained well earned marks for low energy preservation. Some thought that the ornament of fossil G (bark) showed alignment by a current, and therefore deduced that it was high energy.

Question 3

3) (a) Most candidates managed a high score for this part of the question using terms from the geological time scale and it was therefore not a good indicator of the ability of the candidates.

(b) (i) This was generally answered very well. The most common error was to fail to explain how a way up structure indicates the relative age. Centre specific problems included a description of the law of superposition and – and simply stated that the one at the bottom was the oldest. In these cases students used the words 'way up structures' and 'superposition' interchangeably. Some good diagrams again went unlabelled for this part and (ii) and (iii), thus gaining no credit.

(ii) There were excellent diagrams showing dykes and faults for this part of the question. These were often well explained.

(iii) Most candidates gave the idea that old fragments were weathered and redeposited into younger rocks. The most common error here centred on fossils being described as included fragments, without any idea of reworking.

(c) (i) Only a few candidates failed to choose a suitable radiometric dating method. The commonest error was to suggest carbon dating, gaining no marks. Other incorrect responses included lithostratigraphy, absolute dating, varve deposits and ash bands. Some thought the symbol for potassium was P when naming the $K^{40}Ar^{40}$ method of radiometric dating.

(ii) A concise summary of the principles of absolute dating were beyond the ability of most candidates. Many were prepared with a definition of the term 'half life' but were unsure how this was applied to determine the absolute age.

(iii) The knowledge that sedimentary rocks are composed of older rocks was well understood. Few referred to loss of gases and fewer mentioned the diagenetic mineral glauconite.

(iv) Many gained one mark for simply stating 'resetting of the geological clock', but with little in depth of the understanding posed by discordant dates or ideas about different blocking temperatures. Some talked incorrectly about 'melting' as a metamorphic process.

Question 4

4) (a) There was a marked difference in the candidates' ability to label a complete diagram of the standard type of question – which is excellent and this question, where the morphology was incomplete and the candidate needed to draw the features on the outline provided. This skill is seemingly very weak. Diagrams were often random and labelling enigmatic. Some candidates did not draw anything, but simply tried to label the outline diagram of an ammonite.

(b) There were many high quality answers here, complete with labelling and the best represented being the ammonitic suture. Some confused a ceratitic suture for the goniatite, whilst a minority confused ammonitic and gonititic sutures and drew them the wrong way around. A few students drew conispiral and planispiral gastropods, gaining no marks.

(c) This question provided a good opportunity for differentiation between candidates. Many grasped the concept of buoyancy controlled by gas for vertical movement though fewer understood the role of the siphuncle. Almost all were aware of jet propulsion being used for horizontal movement. Only a few candidates were aware of the use of tentacles in movement, and fewer thought that movement was attained using a 'foot'. Some candidates thought that horizontal movement was only achieved via a current, although this was centre specific.

(d) (i) Most candidates plotted the points on the graph accurately for maximum marks.

(ii) Most candidates calculated averages accurately for maximum marks. Many students were unaware of the need to use the appropriate number of significant figures or decimal places to use.

(iii) Most candidates described the distribution of data, but few explained it. One possible answer was the distribution of older and younger specimens; this would not explain the gap in the data, although credit was given.

Teaching Tip

Measuring samples of whole fossils collected in the field makes a good coursework practical for analysis and can also be used to illustrate the methods to illustrate growth stages or different species.

Samples of *gryphaea*, *terebratula* and *rhynchonella* from fossil rich beds such as the in the Jurassic can all be used for long axis measurements in this way.

Question 5

5) (a) Overall the standard of answers was generally excellent for this essay question and a large number of candidates gained full marks. These candidates produced well ordered essays centring on 4 or 5 methods of preservation. Such candidates also produced diagrams to illustrate the methods, complete with labels.

Sadly, the idea of 'preservation' was interpreted by a large number of candidates to mean 'exceptional preservation', which had been an exam question in the past. The work in these instances was often detailed and well informed, often encompassing the general marks in the mark scheme. Such students omitted the main methods and therefore could not attain the highest marks.

Some candidates simply produced a list of processes, without attempting any explanation of each type and how they differ from one another. Quite clearly some teaching does not differentiate these methods as many candidates simply stated the method followed by replacement by that material. The explanations for the formation of pyrite were particularly poor.

The idea of dissolution of hard parts was often badly explained. Some candidates interchangeably use the words 'rotting' and 'decay', instead of 'dissolution', suggesting that a distinction has not been made in teaching.

5) (b) There were many good answers for this question, often with a variety of different morphologies which were correctly labelled. However, there was overemphasis on the soft parts of the bivalves, without the resultant changes in the hard part morphology.

A few candidates described and drew brachiopods, with much discussion about strophic hinge lines, zig zag commisures, pedicles and lophophores. Some thought that a 'byssus' was a foot on which the bivalve could travel along the sea floor, and many referred to these as 'abyssal threads'. A minority thought that bivalves fed using a siphuncle, although this was centre specific. Some candidates were confusing brachiopods and bivalves with brachiopod terms to describe bivalves.

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

Advanced Subsidiary GCE Geology (3884
&Advanced GCE Geology 7884
January 2006 Assessment Session

Unit Threshold Marks

Unit		Maximum Mark	a	b	c	d	e	u
2831	Raw	60	46	42	38	34	30	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	71	64	57	50	43	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	0	0	0	66.7	100	100	6
7884	0	50	100	100	100	100	2

8 candidates aggregated this session

For a description of how UMS marks are calculated see;
www.ocr.org.uk/OCR/WebSite/docroot/understand/ums.jsp

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