OCR
RECOGNISING ACHIEVEMENT

GCE

Geology

Advanced GCE **A2 7884**

Advanced Subsidiary GCE **AS 3884**

Mark Schemes for the Units

June 2006

3884/7884/MS/R/06

Oxford Cambridge and RSA Examinations

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

Mark schemes should be read in conjunction with the published question papers and the Report on the Examination.

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CONTENTS

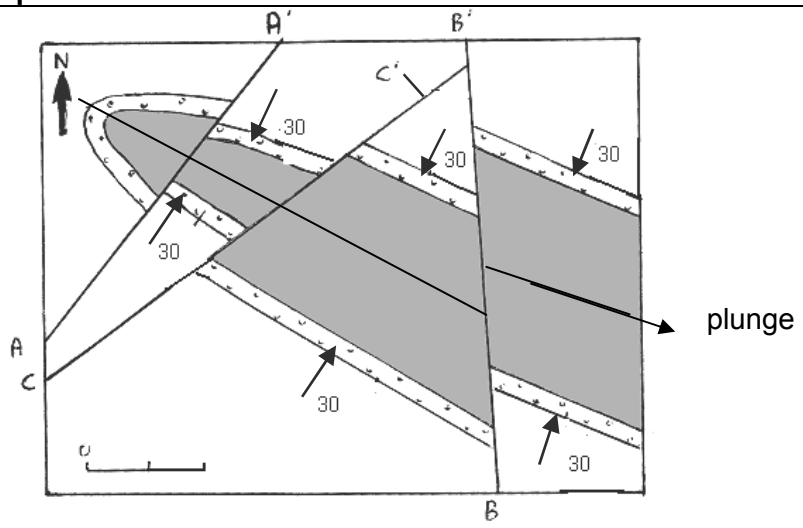
Advanced GCE Geology (7884)

Advanced Subsidiary GCE Geology (3884)

MARK SCHEMES FOR THE UNITS

Mark Scheme 2831
June 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)	as on the map 1 line correct = 1 2 lines correct (either side of fault B) = 2	**2**
	as on the map/S.E.	**1**
(ii)	syncline/synform symmetric plunging open/gentle upright	**Any 2**
(b) (i)	sinistral/left lateral strike slip/tear/wrench/shear lateral/horizontal movement fold axial trace NW – SE/limbs dipping NE and SW	**Any 2**
(ii)	55 m +/- 5 m	**1**
(iii)	horst	**1**

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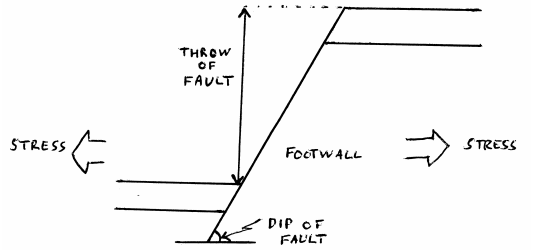
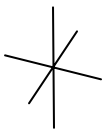
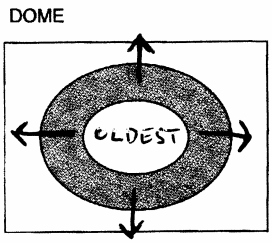
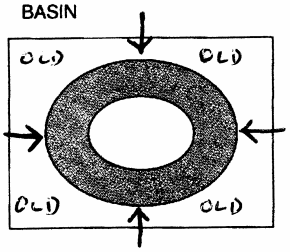
Question	Expected Answers	Marks
1 (c)	 P max  Intermediate stress Min stress If arrows not used allow P max vertical If thrust drawn then max 3 (not the stress mark)	**4**
(d)		
(i)	 dome = as on the diagram (min 3 arrows)	**1**
(ii)	 basin = as on the diagram (min 3 arrows) dome = in the core basin = on the outside (see diag) need both	**1** **1** **Total: 16**

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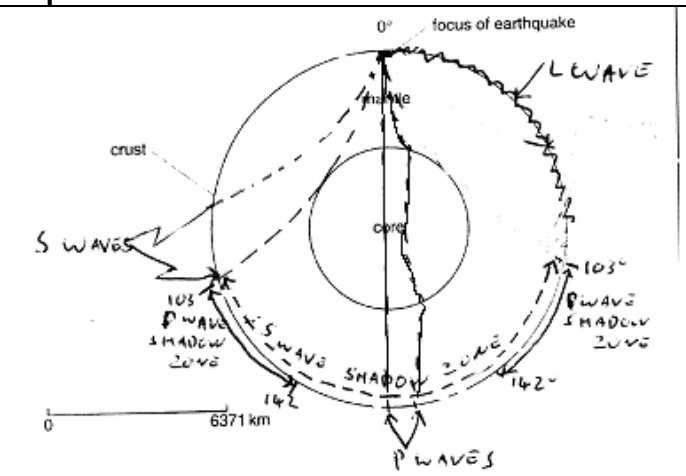
Question	**Expected Answers**			**Marks**
2 (a)				
(i)	Any S wave as on the diagram (anywhere in the mantle) Any P wave as on the diagram L wave as on diagram (must not extend beyond 90°)			**1** **1** **1**
(ii)	S wave shadow as on the diagram/103° - 103° +/- 10° drawn P wave shadow as on the diagram/103° - 142° =/- 10° drawn (if one or more drawn incorrectly but have correct angles written max 1)			**1** **1**
(b) (i)	Density Rigidity/how liquid the rock is/degree of partial melting/ resistance to shearing is zero			**any 2**
(ii)	(5 - 10%) partially melted/rheid/plastic/ductile			**1**

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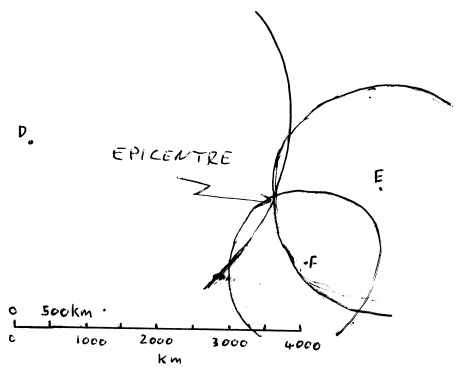
Question	Expected Answers	Marks
2 (c) (i)	peridotite/ultrabasic/ultramafic	**1**
(ii)	stoney meteorites/silicate meteorites/mantle xenoliths/ophiolites (or description)/kimberlite pipes	**1**
(iii)	iron meteorites bulk density greater than the crust and mantle/gravitational pull of the Earth Magnetic field	**any 2**
(iv)	S wave shadow zone/no S waves/production of magnetic field requires liquid outer core/P waves slow down/P wave shadow zone	**1**
(d) (i)	E = 1500 km F = 1000 km	**1** **1**
(ii)	 1 –2 arcs correct = 1 3 arcs correct = 2 epicentre as on diagram (must be labelled)	**2** **1** **Total: 18**

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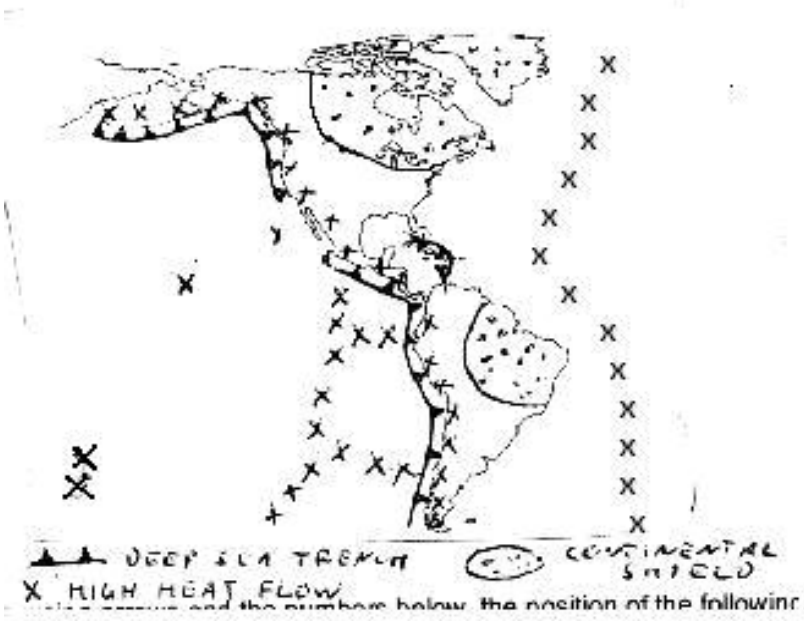
Question	Expected Answers	Marks
3 (a)		
(i)	ocean basin most of the ocean floor (not close to continents or MOR's) continental shield as on the map above high heat flow xxxx on the map above	**1** **1** **1**
(ii)	trench as on map above (parallel to coast and min 2mm from coast)	**1**
(b)		

Tectonic feature	definition	
G	5	**1**
H	4	**1**
J	2	**1**
K	1	**1**

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Question	Expected Answers	Marks
3 (c) (i)		

	Age of the oldest rocks	composition	Average thickness	density
oceanic	200 Ma +/- 50 Ma Jurassic	Basic/sima/ basalt	10 km +/- 5 km	3.0 +/- 0.1
continental	4000 Ma +/- 500 Ma Precambrian	Acid/intermediate/sial/ granite/granodiorite	33 km +/- +/-7 km	2.7 +/- 0.1

Any 1 - 2 correct = 1
Any 3 - 4 correct = 2
Any 5 - 6 correct = 3
Any 7 - 8 correct = 4

4

(ii) ophiolites
deep sea drilling/bore holes into crust
seismic waves indicate solid/thickness/depth to Moho
direct observation/Iceland/dredging/submersibles/shield volcanoes/Hawaii/pillow lavas at MOR/basaltic lavas

any 2

(d) (i) Nazca/Pacific/Caribbean plate/Cocos/Juan de Fuca — **1**

(ii) Indian – Australian /(North) American/South American/African/Eurasian/Antarctic — **1**

Total: 16

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Question	**Expected Answers**			**Marks**
4	**Describe the characteristic features found at destructive plate margins.** **Each feature must be described for a mark** **If list only half marks** **General points** Deep sea trench/ocean trench Fold mountains Benioff zone or description Negative gravity anomalies over trench/positive over mountains Low heat flow over trench/high over volcanoes Volcanoes linked to rising magma Partial melting of oceanic crust Ophiolites (or description) Accretionary prism/wedge (or description) Reverse/thrust faults Folds linked to compression/shortening Regional metamorphism Batholiths/magma chambers **Ocean v ocean** Island arc Basic/basaltic/intermediate volcanoes/andesitic **Ocean v continent** Intermediate/andesitic/acid volcanoes/rhyolitic/pyroclastic **Continent v continent** No volcanoes **Mark diagrams as a list (2 labels = 1 mark)**			**Max 4** **1** **1** **1** **1** **1** **1** **1** **1** **1** **1** **1** **1** **1** **1** **1** **1** **1** **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

Question Total **10**

Mark Scheme 2832
June 2006

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Question			Expected Answers	Marks
1	(a)	(i)	A = lava / lava flows / pyroclastics /*any named extrusive igneous rock*	1
			B = intrusive / intrusions / batholith / dyke / sill / *any named intrusive body*	1
			C = transport / transportation	1
			D = sedimentary / sedimentary rocks / *any named sedimentary rock*	1
		(ii)	lithification / *burial* diagenesis compaction / *burial* dissolution cementation recrystallization (Credit given for *burial* once only)	any 2
	(b)		rocks are poor conductors of heat cooling is slower at depth / ora slower cooling produces coarse crystal grain size / ora	any 2
	(c)	(i)	Igneous / *granite*	1
		(ii)	fragmental / clastic / grains; medium sand / sand sized grains; well sorted; well rounded / *rounded* *high sphericity*	any 2
		(iii)	quartz is resistant / more resistant to weathering / *insoluble / does not undergo chemical weathering* feldspar and mica are more affected by chemical weathering/ *more soluble* quartz is harder and resists abrasion mica is platy and may have been transported and deposited elsewhere.	any 2
		(iv)	attrition / collisions during transport / angular corners chipped off *AW* / wind transport /*transport over long distance / for a long time* abrasion / grains rub together	any 2

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Question	Expected Answers	Marks
1 (a) (v)	Metamorphic / *metaquartzite*	1
		16

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Question			Expected Answers	Marks
2	(a)	(i)	H = ripple marks	1
			J = cross bedding / *current bedding / dune bedding / cross stratification* *(NOT cross lamination)*	1
			K = graded bedding	1
			L = desiccation cracks / *shrinkage cracks / mud cracks*	1
		(ii)	J and K Both correct =	1
		(iii)	cross bedding shows truncation at the top when right way up / the laminae are concave upwards when right way up / *flattens out at the bottom* / ora;	1
			graded bedding has coarser grains at the base when right way up / ora	1
	(b)	(i)	K = settling of debris of variable size / large / *heavy* particles sinking faster than small ones / higher settling velocity of larger particles / low energy allows deposition / *deposition from turbidity currents/density flow* / *sequence repeated*	any 2
		(ii)	L = surface of a sediment exposed to the atmosphere / dries due to evaporation / splitting of sediment due to drying out / mud deposited by water dries out / rapid drying of a surface / *mud shrinks to form cracks / contraction of mud*	any 2
	(c)	(i)	M = oolitic / oolite / *ooliths / oosparite / oomicrite* and N = bioclastic / shelly / crinoidal / *fossiliferous / biosparite / biomicrite.* Both correct =	1
		(ii)	less than 2m / shallow *(note to examiners: must not be >5m)*	1
		(iii)	rolling of a pellet / fragment / shell fragment / *sand grain* ;	1
			in carbonate mud / *layers of calcite / coated in calcium carbonate*	1

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Question	Expected Answers	Marks
(d)	rainwater containing CO_2 becomes carbonic acid it reacts with carbonates / limestone to form soluble hydrogen carbonates $Ca\,CO_3 + H^+ + HCO_3^- \rightarrow Ca^+ + 2HCO_3^-$ *Reaction between rocks and carbonic acid*	 any 2 *max 1* **17**

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Question			Expected Answers				Marks	
3	(a)	(i)	A deposit of sediments/ formed at the mouth of a river where a river enters the sea / a lake / an open body of water where there is a major loss of energy / *still water /sea with no currents /the river slows*				any *2*	
		(ii)						
			topset / topsets				1	
				sands / sandstone / *silts*			1	
				clay / mud / shale / marine shale / *limestone*			1	
	(b)	(i)	A series of layers that are repeated a repeated unit in a vertical succession beds repeated vertically layers repeated due to cyclic sedimentation rock types appear more than once vertically due to repetition of depositional environments / AW				any 1	
		(ii)	coal sandstone shale	**or**	topset foreset bottomset	one repeat unit correctly drawn =	1	
			coal sandstone shale		topset foreset bottomset	all or any part of second repeat unit drawn =	1	
	(c)	(i)	equatorial / *wet /humid* tropical				1	
		(ii)	compaction; due to mass of overlying sediments / porosity reduced / water expelled;				1 any 1	**+** **or**
			coalification; water expelled / heating / loss of volatiles ;				1 any 1	**+** **or**
			carbonisation; solution / chemical action leaves residual film of carbon;				1 any 1	**+** **or**

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Question	Expected Answers	Marks
	lithification / *burial*; changes unconsolidated sediment into rock / cementation of fragments / compaction / *burial. (Allow burial once only)*	1 **+** any 1 **or**
	partial decomposition; *in anaerobic/anoxic/reducing conditions* *Allow 1 mark for name of process and 1 for description*	1 **+** 1 **or**
(iii)	*subsidence /emergence* *changes in sea levels* *delta switching* *isostatic readjustment* *marine transgression / regression*	any 2
(d) (i)	burial metamorphism = R regional metamorphism = P thermal metamorphism = Q 3 correct = 1 or 2 correct =	2 1
(ii)	thermal as produced by heat / *high temperature (and low / little / no pressure)* regional as produced by both heat and pressure / *high temperature and high / higher / greater pressure*	1 1
		17

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Question	Expected Answers	Marks
4	**Differences**	
	1. baked zone above and below sill but only below lava flow	1
	2. sills may include xenoliths of overlying rock but lava flows only include underlying rock	1
	3. sills have two chilled margins but lava flows have one	1
	4. lava flows have vesicles or amygdales at the top but sills do not	1
	5. phenocrysts have random orientation in sills but show preferred alignment in lava flows.	1
	6. lava flows may have pillow shapes but sills do not	1
	7. sills have medium sized crystals in the middle but lava flows have fine crystals only	*1*
	8. lava flows have reddened / weathered top	*1* *1* max 3
	Explanations	
	1. Sill intruded between country rocks but lava extruded onto surface	1
	2. there are no rocks overlying lava flows when they are formed	1 1
	3. sills are cooled by contact with the country rocks at *top and base*	1
	4. pressures are lower at the surface than at depth allowing gas bubbles to rise to the top of lava flows	1
	5. movement of the lava causes any large elongate crystals to line up in the direction of flow.	1
	6. eruption under water.	
	7. sills cool more slowly than lava flows / ora	
	8. lavas are weathered /oxidised at the surface	*1* *1* max 3
	Diagrams (sill ; lava flow) which illustrate the differences. *Diagrams marked as text*	**2**
		8

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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 2833
June 2006

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Question	Expected Answers	Marks
1 (a)	beds dipping (towards valley/south/railway tracks) / accept beds/strata slope downwards; (strong/competent limestone on top of) weak/incompetent shale; permeable limestone on top of impermeable shale; limestone is jointed; rain water will percolate down through limestone (to shale); slip plane will develop between limestone and shale / along bedding plane do not accept angle of slope	any 2
(b) (i)	clay / mudstone / shale / tuff / allow poorly consolidated / uncemented rock	any 1
(ii)	water adds weight; water acts as a lubricant / loss of friction / loss of cohesion; water increases the pore fluid pressure / rocks become saturated / waterlogged / absorb water; presence of water causes swelling (of clay minerals) – reduces strength	any 2
(c)	unconsolidated sands and gravel / uncemented sandstones are weak / interbedded chalk and shales may flow under pressure – tunnel may collapse; unconsolidated sands and gravel / uncemented sandstones / chalk are porous and permeable / leakage of water down faults – tunnel may flood; presence of faults – planes of weakness / danger of movement causing tunnel to collapse / juxtapose different rock types on either side / leakage of water down faults	1 1 1
(d)	expensive; rate of tunnelling will be slow; will have to use drilling and blasting techniques (can be dangerous); possibility of engineering problems – overbreak / underbreak	any 1

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Question	Expected Answers	Marks
(e)		

ground improvement method	application	
rock bolts	prevent loose blocks falling from a tunnel roof	1
grouting / rock drains	prevent leakage of water into a tunnel	1
gabions / rock bolts	support the sides of a road cutting	1
rock drains / gabions	prevent slumping of a slope	1

Total: 13

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Question	Expected Answers	Marks
2 (a) (i)	amount / factor / number of times by which the metal is concentrated to make an (economic) ore deposit; cut off grade / minimum percentage of metal for an economic deposit divided by its average crustal abundance (accept alternative wording)	any 1
(ii)	tin = (0.4 / 0.002 =) 200; copper = (100 x 0.005 =) 0.5	1 1
(b) (i)	cassiterite	1
(ii)	current velocity lowest / deposition on inside of meander bend; current velocity highest / erosion on outside of meander bend; dense ore minerals / cassiterite / gold are preferentially deposited where current velocity drops; ore minerals must be hard / physically resistant / chemically unreactive to withstand erosion and transport; (mark labels as text) (no diagram = max 1)	any 2
(iii)	usually mined on a smaller scale / smaller ore deposits; ore minerals are already separated from gangue minerals; there is less waste rock produced / smaller (unsightly) spoil heaps; subsidence is unlikely to occur; underground mining can disrupt / pollute groundwater supplies; underground mining has greater energy requirements, therefore more atmospheric pollution	any 1
(c) (i)	3+ points correctly plotted = 1 all 5 points plotted correctly and joined with line/curve = 2	2

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Question	Expected Answers	Marks
(c) (ii)	horizontal line / shading at 20 metres depth (accept between 15 – 25 metres)	1
(iii)	gossan capping is left at surface; copper is depleted above the water table / near the surface; copper is taken into solution / dissolved / zone of leaching above water table / near surface; copper is concentrated at / immediately below the water table; copper is re-deposited / precipitated due to change in conditions / from oxidising above to reducing conditions below the water table; copper is concentrated into a smaller volume; unaltered / unweathered / unaffected / original / primary copper ore is at depth	any 3 **Total: 13**

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Question	Expected Answers	Marks
3 (a) (i)	requires abundant plankton / (free-floating) micro organisms / algae / deposition in marine environment; low energy conditions / rapid burial in fine grained sediment; requires low oxygen / anoxic / anaerobic / reducing conditions on sea floor; role of (anaerobic) bacteria causing partial decay; requires temperatures of 50 to 200ºC for the plankton to be converted to petroleum; pressure / compression causing conversion of plankton to oil / gas; formation of kerogen / sapropel the petroleum takes time to mature;	any 3
(ii)	pressure - oil migrates in response to pressure from high to low / down pressure gradient; density – oil is less dense than water in pore space so migrates upwards; viscosity of oil / temperature affects viscosity of oil; permeability of rock – requires permeable rock between source rock and reservoir rock to allow migration presence of impermeable rock / cap rock prevents further upwards migration (must describe, not list)	any 2
(iii)	reservoir rock = highly porous and permeable rock containing oil / rock capable of storing (and yielding) significant quantities of oil	1
	cap rock = impermeable rock – above reservoir rock / prevents oil escaping upwards	1
(iv)	diagram of fault with permeable / reservoir / suitable named rock on one side and impermeable / cap / suitable named rock on the other; impermeable / cap / suitable named rock shown above reservoir rock; oil (with gas above) drawn horizontally at top of reservoir rock adjacent to the fault (mark labels as text) (no diagram = 0)	1

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Question	Expected Answers	Marks
3 (b)	advantages = readily accessible / available / easy to extract / cheaper to extract / doesn't take long to refill / dam and reservoir can be used for other purposes, e.g. recreation, H.E.P. generation	any 1
	disadvantages = water will be polluted / contaminated / require treatment / requires sufficient rainfall in catchment / loss of water through evaporation / water supply may be seasonal / dams are expensive to build / large areas of land may be flooded to build dam and reservoir / dams and reservoirs cause environmental problems – must specify	any 1
(c)	<u>general catchment conditions</u>	
	lack of seismic and volcanic activity – may cause dam to collapse / weight of dam may trigger seismic activity;	1
	lack of mass movement – may have landslides into reservoir;	1
	requires a large catchment with sufficient rainfall;	1
	lack of sediments in feeder streams – possibility of silting up of the reservoir;	1
	impermeable rocks – promote surface runoff;	1
	no mineral veins containing toxic elements, e.g. lead, zinc;	1
	<u>rock type for foundations</u>	
	must have high load-bearing strength / be competent to support weight of dam and water;	1 + 1 for detail
	rock should be impermeable to prevent leakage;	1 + 1 for detail
	clay or mudstone are weak rocks / have low load-bearing strength – may collapse / slip;	1
	limestone – suffers solution / caves / porous and permeable	1
	rock should be uniform to prevent problem of differential subsidence of the dam;	1
	depth of weathered material is important – weakens rock, increases permeability;	1

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
3 (c)	<u>attitude and structures</u> horizontal and strata dipping upstream are stable / strata dipping downstream is unstable (potential for slippage and collapse of dam); lack of faults important – zones of permeability / zones of weakness / old faults may be reactivated / juxtapose different rock types; lack of joints – zones of permeability / weakness; synclines may permit leakage; anticlines may have slippage on limbs / tension joints on crest; <u>other considerations</u> suitable building materials should be close to site (bulk commodity); absence of caves / old underground mine workings; discussion of suitable ground improvement strategies (mark diagrams as text)	1 1 1 1 1 1 max 1 total max = 7 Total: 19

Mark Scheme 2834
June 2006

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Question	Expected Answers			Marks
1 (a)(i)		**group**		
	A	Coral / Cnidaria / Anthozoa / Rugose / Scleractinian / do not accept Tabulate Corals		
	B	Crinoid		
	C	Echinoid / Echinoderm do not accept Micraster		
	D	Graptolite / Hemichordata / Graptolithina / Graptoloid		
		1 mark per row		max 4
(ii)	recognisable drawing of a regular echinoid suitable labels – test, (calcite) plates, ambulacra (narrower than interambulacra), interambulacra, tubercles, spines, pore pairs, periproct/anus, peristome/mouth, apical system / (madreporite) **OR** recognisable drawing of an irregular echinoid additional labels – plastron, labrum, anterior grove, fasciole			1 max 3 **or** 1 max 2
(iii)	similarity – same phylum / both Echinodermata / composed of plates / calcite test / endoskeleton / water vascular system / 5 fold symmetry / paired pores / tube feet / marine organisms / benthonic / epifaunal / accept any correct named morphological feature they both have			

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Question	Expected Answers	Marks
	difference – symmetry / mode of life – B sessile vs. C vagrant / B filter feeder vs. C grazer / spines / anus and mouth in different positions / accept any correct named morphological feature that one has and the other doesn't	
	allow ecf if wrong group identified any pair	1
(b) (i)	brachial valve – smaller valve on either view	1
	brachidium – internal feature – loop structure on internal view	1
	growth line – external feature – on external view	1
(ii)	two arms (brachia) fringed with cilia/tiny hairs / (fluid filled canal) with sticky cilia/tiny hairs / cilia/tiny hairs beat to generate currents / currents carry food / food particles passed along cilia to mouth / filter or suspension feeders	
	do not accept filtering of sediment	any 2
		14

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Question	Expected Answers	Marks
2 (a) (i)	<table><tr><th>term</th><th>description A,B,C,D or E</th></tr><tr><td>replacement</td><td>E</td></tr><tr><td>carbonisation</td><td>A</td></tr><tr><td>silicification</td><td>B</td></tr><tr><td>recrystallisation</td><td>C</td></tr><tr><td>moulds</td><td>D</td></tr></table> one correct = 1 mark two correct = 2 three correct = 3 four or five correct = 4	max 4
(ii)	anaerobic / anoxic / reducing conditions; sulphur-fixing / pyrite-making bacteria / hydrogen sulphide is produced; low energy; requires iron-rich, organic sediment / iron-rich water	any 2
(iii)	aragonite unstable; alters to more stable calcite; polymorphs of calcium carbonate / polymorphs change; if older than Cainozoic - aragonite has been altered to calcite; process of recrystallisation	any 2
(b) (i)	<u>fine grained sediment</u> preserves detail / preserves soft parts / exceptional preservation / preserves trace fossils; clay minerals in sediment are delicate / flexible / don't crush organism; less damage due to no grain impact of larger sediments; usually quieter conditions / fewer currents to break up fossils; less abrasion / attrition / erosion; fine grained sediment has lower permeability – less oxygen / less chance of decay/decomposition; if scavenging occurs preservation potential is less	any 2

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Question	Expected Answers	Marks
2 (b) (i)	high energy conditions breaks up fossils on death / less whole or undamaged specimens; currents / wave action responsible; disarticulation occurs; coarser sediment will crush organisms / less detail preserved; if scavenging occurs preservation potential is less	any 2
	early diagenesis alteration early means less loss of features; direct replacement of minerals yields high amount of detail; original material may be preserved; organism subjected to less pressure before it hardens; less chance of decay / decomposition / predation / scavenging	any 2
(c)	amber sap/resin flows down tree trapping organisms; no chance of decay due to rapid trapping; anoxic / anaerobic / no oxygen present; preserves chitin or exoskeleton; hardens / recrystallises to form amber	max 2
	tar animals (attracted to tar) and fall in / get stuck; attracts other animals; anaerobic causes little decay; antiseptic properties causes little decay; preserves whole organism	max 2
		max 3 **17**

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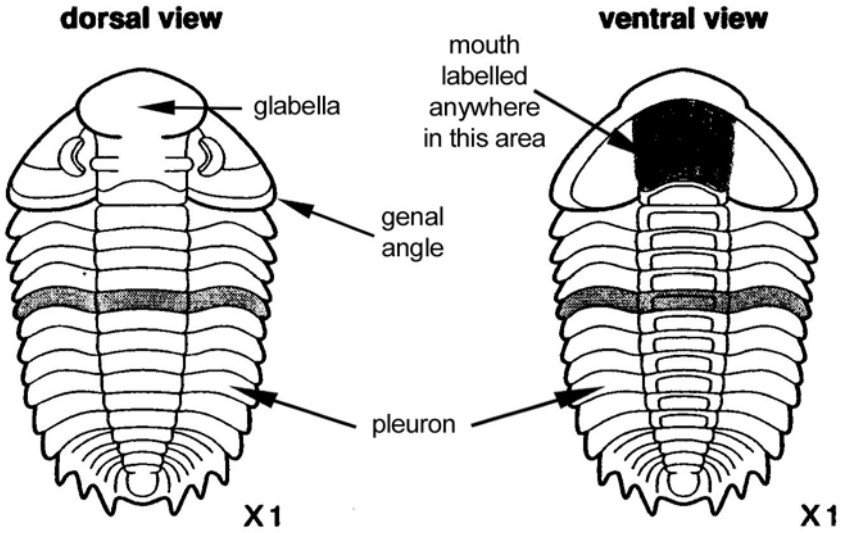
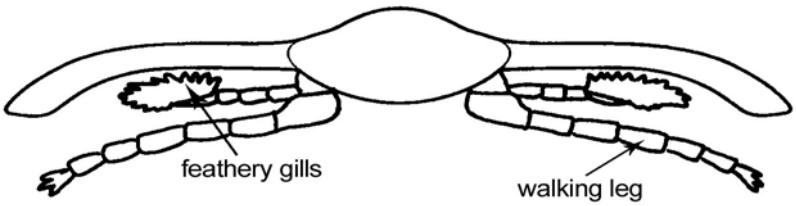
Question	Expected Answers	Marks
3 (a) (i)		
	genal angle – on either specimen at edge of cephalon;	1
	glabella – central area of cephalon on dorsal view;	1
	mouth – indicated in central area of anterior end on ventral view;	1
	pleuron – shaded or indicated on dorsal or ventral view;	1
(b) (i)		
	pair of feathery gills close to edge of axial lobe on underside above walking legs	1
	pair of legs / jointed / walking legs on each side of underside	1
	if both correctly labelled on one side only = max 1	

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Question	Expected Answers	Marks
3 (b) (ii)	jointed appendages/legs / complex limbs; exoskeleton; composed of chitin; segmented body / evidence of articulation; compound eyes; growth by ecdysis / moulting	any 2
(c)	nektonic separated pleura; allow greater surface area to float / greater flexibility to swim inflated glabella; floatation device to remain in water column spines present; for protection eyes facing forwards / downwards / protruding from cephalon; life above sea floor / allows catching of food / detection of predators allow max one if written for planktonic	max 2
	infaunal no eyes / blind / eyes on stalks; eyes not needed either nocturnal or live in burrow / deep water pitted cephalon / sensory hairs present / cephalic fringe / doublure / pits contain a water bubble; allow animal to make sense of environment / detect currents / bubble acts as a spirit level large shovel shaped cephalon; burrowing into sediment / increase surface area on soft sediment genal spines extended; for increased stability in soft sediment	max 2

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Question	Expected Answers	Marks
3 (c)	planktonic small body / light weight; for floating in water column few thoracic segments; no need for flexibility/enrolment / had few legs – no need to swim/walk inflated glabella and or pygidium / fat or gas filled / separated pleura; for buoyancy in water column allow max one if written for nektonic paired answers - 1 for each morphological adaptation, 1 for explanation	max 2
(d) (i)	Fossil J resting trace/mark / trilobite stationary / marks from exoskeleton / gills or legs	any 1
	Fossil K walking traces/marks / (double imprint) may be legs and gills touching sediment / made by movement	any 1
(ii)	fit for life and aerobic / oxygenated sea floor; soft substrate / fine grained sediment to leave marks; lack of currents / low energy / sediment movement destroy traces; wouldn't form if rapid sedimentation; organic material available for food	any 2
		18

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Question			Expected Answers		Marks
4	(a)		marine species;		1
			trilobites; rugose corals; (either way round)		1 + 1
			brachiopods;		1
			amphibians		1
	(b)	(i)	recognisable drawing of a solitary rugose coral – horn / cylindrical shape		1
			any two suitable labels – corallum/corallite, septa, tabulae, dissepiments, axial structure/columella, calice, major and minor septa, wrinkled		1
		(ii)	**Scleractinian**	**Rugose**	
			tabulae sometimes present/ rare/none	tabulae *always* present	
			dissepiments always	dissepiments sometimes	
			radial symmetry	bilateral symmetry	
			not extinct / extant / Triassic-Recent	extinct / Ordovician-Permian	
			no axial complex *or rare*	axial complex	
			6 primary septa, then inserted at 6 points	6 primary septa, then inserted at 4 points	
			any two pairs as comparisons		any 2
	(c)	(i)	65 Ma (+ / - 5 Ma)		1
		(ii)	Ammonites / Ammonoids;		
			Belemnites;		
			Ichthyosaurs / reptiles;		
			some microfossils		any 2
		(iii)	Chicxulub / Yucatan Peninsula meteorite crater / present off the Gulf of Mexico; shape of crater – bowl and rim;		
			tektites / glass; brecciated rock;		
			shocked quartz / high T & P quartz polymorphs – stishovite & coesite;		
			high levels of iridium (in boundary clays);		
			widespread tsunami / tidal wave deposits		any 2

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Question	Expected Answers	Marks
4 (c) (iv)	large scale volcanic activity (Deccan Traps – India) / continental flood basalts / huge volumes of magma erupted over short time scale; global implications for climate change explained – ash, dust and sulphur dioxide caused "volcanic winter" / initial global cooling / longer time scale global warming (due to erupted CO_2) / acid rain (due to erupted SO_2) / volcanism caused changes in sea water chemistry / volcanic activity triggered forest fires **OR** increased volcanic activity at mid ocean ridges; leading to sea level rises	1 1 **or** 1 1 **16**

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Question			Expected Answers	Marks
5	(a)	**1**	diagrams of pendent / two-stiped form, e.g. Didymograptus	1
		2	diagrams of biserial form, e.g. Diplograptus	1
		3	diagrams of scandent form, e.g. Monograptus	1
		4	diagrams of uniserial / horizontal / reclined forms, e.g. Dicellograptus or Didymograptus	1
		5	diagrams of thecal shape	1
		6	labels on diagrams	1
		7	3 or more correctly named genera	1
			diagram marks	max **5**
			no marks for dendroids	
		8	early forms Ordovician	1
		9	had numerous branches / to 4 stipes, e.g. Tetragraptus	1
		10	later Ordovician – two-stiped (pendent) forms, e.g. Didymograptus	1
		11	reclined or horizontal forms, e.g. Dicellograptus	1
		12	single-stiped forms with thecae back-to-back (biserial), e.g. Diplograptus	1
		13	mixed forms, e.g. Dicranograptus / scandent forms	1
		14	the direction of growth of the stipes evolved from pendent to scandent	1
		15	single row of thecae on single stipe (uniserial), e.g. Monograptus	1
		16	these are Silurian	1
		17	thecae evolved different distinctive shapes / became more complex	1
		18	detail of simple / sigmoidal / hooked / isolated theca / details of thecal shapes	1
		19	general evolution from forms with more branches and many individuals to forms with few or only one branch and very few individuals	1
		20	complex forms of curves and spirals, e.g. Cyrtograptus	1
			if list / diagrams only = max	6
			no diagrams = max	10
				max **11**

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Question	Expected Answers	Marks
5 (b)	**Bivalves**	
1	**Internal** – internal diagram of shell (with labels)	1
2	soft tissues (mantle) occupying area between shells / siphons	1
3	siphons extend beyond shells / separate inhalant and exhalent currents	1
4	muscular foot discussed	1
5	pallial line and sinus	1
6	muscle scars / teeth and sockets / ligament identified	1
7	**External** – external diagram of shell (with labels)	1
8	two valves / hinged valves / left and right valves	1
9	line of symmetry along hinge line / equivalve	1
10	detail of adapted forms with a byssus, e.g. Mytilus	1
11	detail of cemented forms, e.g. Ostrea	1
12	other detail of adaptation such as Pecten or suitable form	1
13	ornament types discussed – ribs and growth lines	1
	Bivalves on discussed	max 7
	Cephalopods	
14	Cephalopods have chambered shells	1
15	chambers connected by a siphuncle	1
16	animal lives in final chamber / soft tissue of animal extends out of shell / has head and tentacles	1
17	gas or minerals in chambers help buoyancy / use of siphuncle to adjust buoyancy	1
18	funnel / siphon used for jet propulsion	1
19	thin shells of Cephalopods do not allow life in high energy environments	1
	Nautiloids	
20	**Internal** – internal diagram of shell (with labels)	1
21	position of siphuncle central	1
22	shell divided by straight chambers / suture straight	1
23	**External** – external diagram of Nautilus or orthocone nautiloid (with labels)	1
24	poorly ornamented shell / growth lines only	1

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Question			Expected Answers	Marks
5	(b)	25	**Ammonoids** – planispiral coiling	1
		26	**Internal** – internal diagram of shell (with labels)	1
		27	position of siphuncle (eccentric)	1
		28	different suture types drawn (from goniatitic, ceratitic or ammonitic)	1
		29	**External** – suitable diagram of external features (with labels)	1
		30	coiling types distinguished / involute and evolute	1
		31	ornament types compared / ribs and growth lines	1
		32	**Belemnoids / Coleoid** – orthocone / straight shell	1
		33	diagram of belemnite (internal or external) with labels	1
		34	guard makes up internal skeleton / surrounded by soft tissue	1
		35	chambers and siphuncle present in alveolus	1
		36	other correct named morphological feature of Bivalves and Cephalopods compared	1
			Cephalopods only discussed no diagrams = max 10	max 7 max **12**

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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**

Mark Scheme 2835
June 2006

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Question			Expected Answers	Marks
1	(a)	(i)	A = Basic or any named rock B = Acid or any named rock C = Intermediate or any named rock D = Ultrabasic or any named rock	1 1 1 1
		(ii)	% of silicon increases from U/B to A/ % of sodium increases form U/B to A % of iron decreases from U/B to A/ % of magnesium decreases from U/B to A *In acid and intermediate rocks (B and C), the silicon and sodium percentages are greater than in basic and Ultrabasic rocks (A and D)* *In the basic and Ultrabasic rocks (A and D) the magnesium and silicon percentages are greater than in acid and intermediate rocks (B and C)* *Higher % of silicon and sodium, lower the % of iron and magnesium* *Higher % of iron and magnesium, lower the % of silicon and sodium* *NO LISTS MUST BE A COMPARISON BETWEEN SILICON AND SODIUM AND IRON AND MAGNESIUM*	Any 1 Any 1 *1* *1* *1* *1*
		(iii)	SiO_2 is measured as total % in rock SiO_2 can be combined with other elements to form silicate minerals / all SiO_2 is used to form silicate minerals Free quartz only forms as a result of an excess in silica	Any 2
	(b)	(i)	Average size of ALL crystals within the rock	1
		(ii)	3mm +/- 1mm	1

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Question			Expected Answers	Marks
1	**(b)**	**(iii)**	C = Porphyritic Large crystals (phenocrysts) form first (in hypabyssal environment), followed by more rapid cooling of the groundmass (in a volcanic environment) / 2 stages of cooling	1
		(iv)	A = Ophitic / *Poikilitic* Feldspar laths (*enclosed mineral*) form first, followed by pyroxene (*enclosing mineral*) cooling slowly / Simultaneous crystallisation with sites of nucleation closer together E.C.F.	1
	(c)	**(i)**	Mineral(s) that contain iron and / or magnesium/ Dark coloured minerals	1
		(ii)	pyroxene and olivine	1
		(iii)	Calcium rich plagioclase occurs in basic igneous rock, rock A / A and C Percentage of sodium increases as move through intermediate (rock C), to acid (rock B) A (Basic) is high in Calcium (9%) C (Intermediate) still high in Calcium (7%) B (Acid) is low in Calcium (1.5%) More acidic/ silica rich will be Sodium rich More basic/ silica deficient will be Calcium rich A crystallisation proceeds plagioclase feldspar becomes richer in sodium	1 1 *Any 2* 1 1 1 **Total 18**
2	**(a)**	**(i)**	E = Rudaceous - Pebbles / Gravels / Boulders/ Course G = Argillaceous / Muds / Silts/ Fine	1 1
		(ii)	G is low energy and E is high energy / (G) fine material deposited last, (E) heavy material deposited first	Any 1

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Question			Expected Answers	Marks
2	**(b)**	**(i)**	Angular / sub angular fragments / poorly sorted = texturally immature	1
			Many fragment types / polymictic / contains potash feldspar = compositionally immature Allow e.c.f.	1
			Texturally / compositionally immature	Max 1
		(ii)	Breccia / Breccia-conglomerate / Conglomerate / Arkose Allow e.c.f.	1
		(iii)	Alluvial fan Allow e.c.f	1
	(c)		Desert Medium sand / Scale Monomineralic / Quartz Well rounded / millet seed Well sorted Frosted grains Iron oxide coating	4 Points = 2 2 points = 1
			Appropriate diagram	1
	(d)	**(i)**	Playa / Ephemeral	
		(ii)	Chemical weathering in uplands Minerals transported (as ions) in solution Evaporation of lake Minerals crystallised/ precipitate (from solution) Lower solubility minerals first (carbonates) / most soluble last (potassium salts)	Any 2
		(ii)	Salt crystals form when lake dries up Salt crystals dissolves Mould infilled (with sediment/ secondary mineral) Shape of original salt crystal preserved	Any 2
	(e)		H =Haematite I = Quartz J = Biotite Mica	1 1 1
				Total 17

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Question	Expected Answers	Marks
3 (a)	Temperature = Higher the temperature greater degree of Change / *coarser crystal grain size* *Longer time temperature is involved the greater change* Lower temperature minerals replaced by those stable at higher temperature = Prograde Higher temperature minerals replaced by those stable at a lower temperature = Retrograde Minerals plastic allows diffusion of ions Gases lost at higher temperatures Increasing temperature *Higher temperature, higher grade of Metamorphism* *New minerals form as a result of increased temperature* *Increased temperature original structures/fossils destroyed*	Any 2
	Pore Pressure = Pressure exerted by fluids in pore spaces, / presence of water	Any 2 1
	Load Pressure = Pressure exerted on a rock at depth due to mass of rock above.	1
	Compressive stress / direct pressure – pressure by tectonic processes / compressive forces acting on rock leading to mineral alignment/ foliation of minerals *Higher pressure, higher grade of metamorph*	
(b) (i)	Limestone = Marble Sandstone = (Meta) quartzite	Any 2
(ii)	Shales are polymineralic / consist of a wide variety of minerals Clay minerals contain a wide variety of elements New minerals stable under new T and P conditions Fine grain size increases rate of reaction	1 1 1

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Question			Expected Answers	Marks
3	(b)	(iii)	Zone = sequence of metamorphic rocks characterised by the appearance / presence of a characteristic index mineral/ area showing same grade of metamorphism Index Mineral = (first appearance of a new) mineral, used to define a zone/ mineral used grade Isograd = line joining points of equal metamorphic grade/boundary between metamorphic zones	2
		(iv)	2/3 correct isograds = 1 4 correct isograds = 2 If points joined	Max 1
	(c)		Andalusite is indicative of high temperatures and low pressures / Thermal metamorphism Kyanite is indicative of high temperatures and high pressures / Regional Metamorphism Sillimanite is indicative of high temperatures and range of pressures grades of metamorphism NB allow temperature / pressure comparisons between polymorphs	Any 2
	(d)	(i)	Calcite = Silica > Wollastonite /$CaSiO_3$ / Calcium silicate + Carbon dioxide	
		(ii)	Loss of carbon dioxide Not a closed system	1

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Question			Expected Answers	Marks
4	(a)	(i)	Tin = Cassiterite	1
			Copper = Chalcopyrite	1
			Lead = Galena	1
			Zinc = Sphalerite / Zinc-blende	1
		(ii)	Late stages in crystallisation of granite	
			Higher temperature/ least soluble minerals form first close to intrusion	
			Lower temperature /least soluble minerals form last further from intrusion	Any 2
			Temperature decreasing from intrusion	Max 1
	(b)	(i)	Gangue = non-economic minerals in an ore /	
			They form waste during mining process	Any 1
			Example = Barytes / Quartz / Fluorite / Calcite/ iron pyrites	Any 1
		(ii)	Symmetrical pattern	1
			Country rock on outside	
			Early formed (named) mineral on vein wall	
			Later formed (named) minerals towards centre of vein	Any 2 labelled
	(c)		Final stages of crystallisation	
			Magma is water rich / has a high concentration of volatiles (fluorine and boron)	
			Contains many dissolved ions	
			Has a lower viscosity than magma allowing it to migrate	
			Fluids percolate into country rock/ through fractures/ joints	Any 3
				Total: 13

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Question	Expected Answers	Marks
5 (a)	*Gravitational settling/ magmatic segregation*	*1*
	Minerals with highest temperature form first	*1*
	Denser than surrounding liquid therefore sink	*1*
	Known as cumulus crystals	*1*
	Form layer rich in this mineral at base	*1*
	cumulate layer	*1*
	Remaining liquid depleted in early formed constituents	*1*
		Max = 4
	Fractional crystallisation	*1*
	Minerals form in a distinct order / crystallize in a distinct order	*1*
	Known as Bowens Reaction Series	***1***
	Olivine forms first on discontinuous side	***1***
	Later minerals become progressively richer in iron	***1***
	Ca rich plagioclase forms first / becomes richer in Na	***1***
	Magma becomes more acidic / felsic	***1***
	Quartz is the last mineral to form	***1***
	Only forms if magma saturated in SiO_2	***1***
	2 distinct arms, Discontinuous and Continuous	***2***
	Case studies of Palisade or Skaergaard Max = 2	
		Max = 8
	Filter Pressing	*1*
	Mechanical squeezing of the melt	*1*
	As a result of earth movements	*1*
	Magma starts to crystallize with early formed crystals	*1*
	Melt squeezed, early formed crystals removed	*1*
	Left with magma depleted in early formed crystals	*1*
	Aplite veins are an example	*Max = 4*
	Assimilation / contamination	***1***
	Magma rises towards surface	*1*
	Melts (incorporates) some country rock)	*1*
	Changes composition accordingly	*1*
	Incomplete assimilation shown by xenoliths	*1*
		Max = 3

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Question	Expected Answers	Marks
5 (a)	Magma mixing Process by which 2 magma sources mix Gives rise to a magma of a different composition Often leads to composite intrusions Mark diagrams as text	*1* *1* *1* *1* *1Max = 3* ***Total: 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**

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Question	Expected Answers	Marks
5 (b)	Products:	
	Oolitic limestone	1
	Spherical grains of aragonite/ calcite / calcium carbonate in cement	1
	Fossiliferous limestone/ bioclastic / shelly / reef	1
	Broken shell fragments	1
	Micritic limestone	1
	Fine grained lime rich mud	1
	Chalk	1
	Skeletal remains of micro-organisms	1
	Known as coccoliths	1
		Max = 9
	Processes:	
	Limestones commonly form in specific conditions:	
	Oolitic limestone:	1
	Nucleus	1
	Rolled along shallow beach or sand bank	1
	High energy conditions	1
	Water saturated in calcium carbonate	1
	Calcium carbonate (aragonite) deposited around	1
	nucleus/ concentric layers	1
	evaporation / Precipitation from sea water	1
	Micritic limestone:	1
	Low energy conditions	1
	Calcareous algae, which breaks down when algae die	1
	In lagoon behind sheltered barrier	1
	Food for organisms living in lagoon	1
	Evaporation of sea water	1
	Precipitation of calcium carbonate	1
	Chalk is a specific form of micrite	

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Question	Expected Answers	Marks
5 (b)	Reef / fossiliferous Limestone: Found on barrier or front of barrier Either well preserved(barrier) or fragmental (front) Due to moderate or high energy conditions Fossils cemented by calcite in form of sparite Which is post-depostional Mark diagrams as text	1 1 1 1 1 Max = 9 Total 11 Max = 3 **Total 11**

Mark Scheme 2836
June 2006

Abbreviations, annotations and conventions used in the Mark Scheme	/	=	alternative and acceptable answers for the marking point
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Question			Expected Answers	Marks
1	(a)	(i)	near centre of mudstone bed in 2 parts left of F1 and right of F1	1
		(ii)	between 10° and 30°	1
		(iii)	anticline / antiform; asymmetrical / upright / open / dips north wider outcrop and south / 41/42/44 narrow outcrop / dips point out / dips away from each other	1 any 1
	(b)		beds laid down mudstone oldest, then sandstone, then siltstone folding into anticline faulted by 2 N - S trending faults fault lines intruded by intermediate discordant / dyke intrusions time gap / erosion of beds to form unconformity conglomerate laid down (unconformity) area tilted to NW at 6° intrusion of basic dyke F1 fault after F1 is tear fault as axis displaced erosion max = 5 if sequence described inverted if list, max = 4 and QWC=0	any 9

QWC

1 mark The candidate is able to communicate knowledge and ideas adequately, 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.

QWC 1

Total 14 marks

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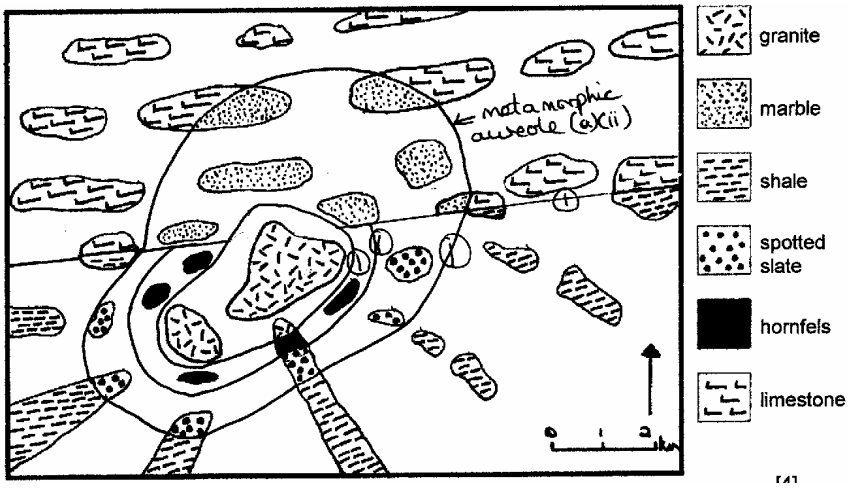
Question			Expected Answers	Marks
2	(a)	(i)	edge of granite allow 2 separate granites	1
			limestone / marble and shale E - W boundary	1
			spotted slate zone	1
			hornfels zone	1
				
		(ii)	edge of metamorphic rocks	1
	(b)	(i)	equigranular crystals/ granoblastic / totally recrystallised / granular texture / fractures unevenly / hard	1
		(ii)	partial recrystallisation	1
			growth of new minerals - biotite / organic material with iron	1
	(c)	(i)	xenolith	1
		(ii)	fragment of roof rock / country rock / overlying sediment falls in stoping	
			partially assimilated / not melted	any 2
	(d)	(i)	feldspar / orthoclase / plagioclase	1

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Question	Expected Answers	Marks
2 (d) (ii)	batholith forms by partial melting of the continental crust forms at depth >10km / slow cooling magma moves up by diapiric action / stoping / emplaced in crust	any 2 **14**

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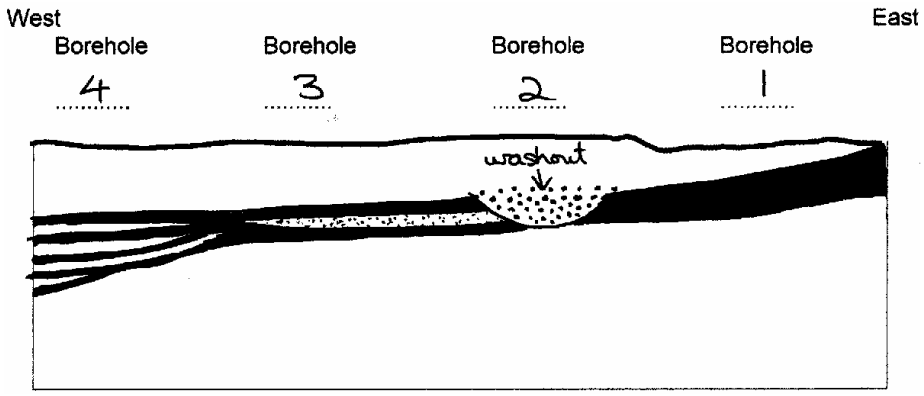
Question			Expected Answers		Marks
3	(a)	(i)	**Fossils**	**Group**	
			A, B and D	plants	1
			C	bivalve	1
		(ii)	no		
			because plants are non marine / land based		
			bivalves are freshwater / brackish water / marine		
			both fossil groups are found in a restricted area / not wide geographical location		
			because no clear / rapid evolutionary pattern for either group		any 3
	(b)	(i)			
			I mark for each correct borehole		max 4
		(ii)	washout formed by a river channel eroding the coal and depositing sandstone ecf		1
	(c)		angle of dip greater than 5° causes problems for machinery		
			displacement by faults causes seam to be removed from mining area		
			water flowing down fault lines causes flooding		
			faults mean risk of further movement - earthquakes		any 3
					13

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Question	Expected Answers	Marks
4	sketch quality recumbent fold closed fold fault joints perpendicular to beds / mineral veins in joints in sandstone / formed by pressure solution amount / direction of displacement / correct dip measurement of fault plane 40° thick competent beds / sandstone beds shale bed / plastic/incompetent beds / bed thickness varies generally thin dip of limbs of fold top 35° bottom 20° axial plane of fold forces described or labelled to show compression diagram max 5 description max 5	**8**

QWC

1 mark The candidate is able to communicate knowledge and ideas adequately, 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 1

Question Total **9**

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Question			Expected Answers	Marks
5	**(a)**	**(i)**	A micaceous sandstone	1
			B graptolitic shale / marine shale / black shale	1
			C greywacke	1
		(ii)	shallow sea / river / moderate to high energy not aeolian	1
			deep sea / calm / low energy / ocean basin / anaerobic bottom conditions	1
			turbidite deposition on deep sea floor / with turbidity currents / submarine fans	1
	(b)	**(i)**	basalt	1
		(ii)	columnar jointing	1
		(iii)	slow steady cooling round centres	1
			contraction to form hexagonal vertical joints	1
			if pillow lava identified in (ii) allow ecf for (iii) rapid cooling on outside, magma within pillow eruption of lava underwater	
				10

Advanced GCE Geology 3884/7884
June 2006 Assessment Series

Unit Threshold Marks

Unit		Maximum Mark	a	b	c	d	e	u
2831	Raw	60	44	38	32	27	22	0
	UMS	90	72	63	54	45	36	0
2832	Raw	60	46	40	34	29	24	0
	UMS	90	72	63	54	45	36	0
2833	Raw	120	93	83	73	63	53	0
	UMS	120	96	84	72	60	48	0
2834	Raw	90	67	60	53	46	40	0
	UMS	90	72	63	54	45	36	0
2835	Raw	90	56	48	40	33	26	0
	UMS	90	72	63	54	45	36	0
2836	Raw	120	89	79	69	59	49	0
	UMS	120	96	84	72	60	48	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	17.9	37.7	59.7	77.3	91.4	100.0	1223
7884	23.6	48.6	71.3	88.8	97.1	100.0	753

1976 candidates aggregated this series

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

Statistics are correct at the time of publication

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