

Geology

Advanced Subsidiary GCE

Unit **F791**: Global Tectonics

Mark Scheme for January 2013

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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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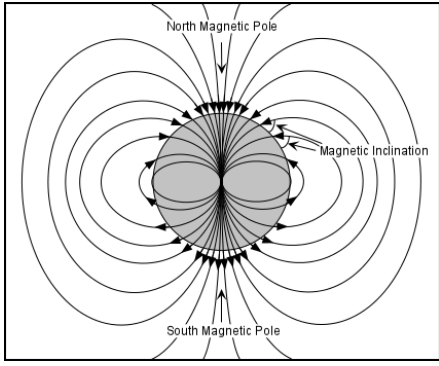
Annotations

Annotation	Meaning
	Unclear
	Benefit of doubt
	Contradiction
	Cross
	Error carried forward
	Ignore
	Benefit of doubt not given
	Poor diagram
	Reject
	noted but no credit given
	Tick
	Omission mark
	Maximum (marks available for) Response

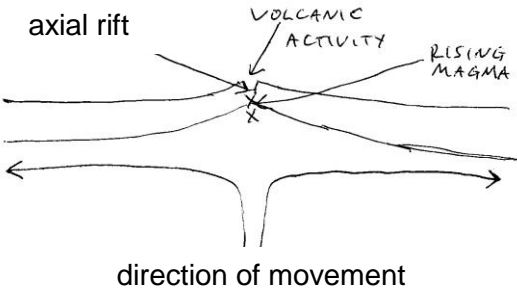
Annotation	Meaning
DO NOT ALLOW	Answers which are not worthy of credit
IGNORE	Statements which are irrelevant
ALLOW	Answers that can be accepted
()	Words which are not essential to gain credit
—	Underlined words must be present in answer to score a mark
ECF	Error carried forward
AW	Alternative wording
ORA	Or reverse argument

Question	Answer	Marks	Guidance
1 (a) (i)	(the point) <u>within the Earth</u> where the earthquake originates OR (point) <u>within the Earth</u> where the fault moves OR the point directly below the epicentre OR where the energy is released OR within the Earth where seismic waves originate	1	
	(ii) epicentre	1	spelling must be correct
	(iii) 0–70 km	1	must give the full range needs the correct units
	(iv) the rocks are too hot OR rocks are at a high temperature OR rocks are (partially) melted; rocks are ductile OR plastic OR rheid OR do not fracture; no friction OR stress unable to build up OR no strain energy OR no elastic rebound;	2	any two points ACCEPT rocks flow OR lose rigidity ORA (eg not brittle) DO NOT ALLOW warm for temperature DO NOT ALLOW no energy
(b) (i)	seismic gap description map epicentres of earthquakes OR make a note of the dates and location that the earthquakes occur OR look for a gap along the fault where there are no earthquakes OR look for average time between earthquakes along a fault seismic gap explanation zone where stress has not been released OR gap is where an earthquake is most likely to occur OR the fault sticks and then moves suddenly to form earthquake	any 1 any 1	for each method 1 mark is for the description and 1 mark for the explanation
	gas measurements description measure levels of <u>radon</u> gas OR <u>radon</u> gas is released from the ground gas measurements explanation levels of gas should <u>increase</u> prior to an earthquake OR sudden decrease immediately before an earthquake OR radon released due to the formation of microfractures OR due to compression of the rock OR radon in groundwater increases before an earthquake OR radon in groundwater decreases before an earthquake OR radon increases and then decreases	any 1 any 1	

Question		Answer	Marks	Guidance
	(ii)	panic causes crowd crushes OR increased car accidents OR city evacuated and business closed OR evacuation takes place but no earthquake occurs OR evacuation saves lives OR no earthquake happens and sued for loss of earnings OR inability to evacuate OR looting	1	accept any sensible alternative DO NOT ALLOW just panic
(c)	(i)	(amount of) energy released OR energy of the earthquake	1	DO NOT ALLOW strength or power or amplitude ALLOW magnitude
	(ii)	<u>amplitude</u> of P or S wave OR <u>amplitude</u> of seismic wave OR <u>amplitude</u> of earthquake wave	1	ALLOW correctly indicated on a diagram of a seismogram
	(iii)	gas pipes fractured OR no water to put fire out as water pipes are fractured OR (overhead) damaged power cables	1	
	(iv)	rubber blocks at the top of concrete columns holding roadways reduce movement extra steel reinforcing in the concrete to add strength; stronger or deeper foundations to give stability cross bracing OR birdcaging to stop twisting (any) base isolation system separates the building from the ground flexible structures to allow buildings to move	1	any one point but needs to describe how it works:
Total			14	

Question			Answer	Marks	Guidance
2	(a)	(i)	 <p>The diagram shows a cross-section of Earth with magnetic field lines. The North Magnetic Pole is at the top, and the South Magnetic Pole is at the bottom. Field lines emerge from the North Magnetic Pole and loop back to the South Magnetic Pole. An arrow labeled 'Magnetic Inclination' points to the angle between a field line and the horizontal at a specific latitude.</p>	1	1 mark for 4 correct lines
		(ii)	convection cells OR moving liquid iron OR self-exciting dynamo OR dynamo <u>liquid, iron, outer core</u>	1 1	need all 3 points ACCEPT liquid, magnetic, outer core
		(iii)	<u>iron minerals</u> (in magma) align (parallel) to the magnetic field igneous (basalt, dolerite, gabbro) rocks cool (below the Curie point) and fixes magnetism OR freezes minerals at that time OR preserved as permanent OR remnant magnetism	1 1	DO NOT ALLOW particles ALLOW AW ALLOW remnant magnetism
		(iv)	magnetic inclination links to latitude of formation OR palaeolatitude; at the equator inclination is 0° OR at poles 90°; may change over time on a continent indicating a change in latitude construction of (apparent) polar wandering curves; polar wandering curves match (continents joined) OR continents separate when polar wandering curves are different	any 1 any 1	any two points ALLOW annotated diagrams as text

Question	Answer	Marks	Guidance
(b)	<p>rocks have same characteristics OR same composition OR same rock types OR matching sequences of rock OR same age of rocks</p> <p>match up across the join</p> <p>ALTERNATIVE ANSWER</p> <p>example – (Precambrian) cratons (can be a diagram); now on different continents match up</p> <p>example (Carboniferous) glacial deposits OR tillites (can be a diagram); formed near poles but are now found in tropical areas so continents moved OR glacial rocks match up across the join;</p> <p>example coal formed in tropical OR equatorial locations but now in different location</p> <p>example desert sandstone only forms in tropical areas now found in temperate areas such as UK so continents moved</p> <p>example reef limestone only forms in tropical areas now found in temperate areas such as UK so continents moved</p> <p>example evaporites only forms in tropical areas now found in temperate areas such as UK so continents moved</p>	<p>any 1</p> <p>1</p> <p>1 + 1</p>	<p>ALLOW structures such as folds OR faults match up;</p> <p>specific example = 1 explanation = 1</p>
	Total	9	

Question	Answer	Marks	Guidance
<p>3 (a)</p>	 <ul style="list-style-type: none"> • volcanoes in axial rift area drawn and labelled • axial rift drawn and labelled in centre • magma rising OR magma chamber labelled below axial rift • arrows showing plates moving apart OR convection currents 	<p>3</p>	<p>max 1 mark if only a plan view</p> <p>2 correct labels = 1 3 correct labels = 2 4 correct labels = 3</p> <p>arrows must be labelled</p>
<p>(b)</p>	<p>description very hot water OR water at 350°C – 400°C OR forms a chimney OR vent OR pipe OR hot springs OR hydrothermal fluids</p> <p>explanation seawater enters rocks and is heated and rises up; dissolved minerals precipitated OR dissolved metals precipitated OR metal sulfides of iron / copper / zinc; minerals precipitated on contact with cold seawater;</p>	<p>1</p> <p>1</p>	<p>allow deposited instead of precipitated</p> <p>any one explanation point:</p>

Question	Answer	Marks	Guidance
(d)	tectonically stable OR aseismic OR no volcanoes OR away from plate boundaries OR centre of plates; Precambrian rocks OR rocks are greater than 1 billion years OR oldest rocks on Earth; composed of igneous <u>and</u> metamorphic rocks; heavily deformed; low relief OR flat land OR heavily eroded;	2	1 or 2 correct points = 1 marks 3 correct points = 2 marks
(e)	at <u>convergent</u> margins where there is compression OR at <u>convergent</u> margins where there is collision OR <u>convergent</u> plate margins where there is subduction; where sediment is scraped up from the ocean floor OR ophiolite formation OR uplift; where rocks are folded OR form reverse faults OR form thrust faults OR forms nappes OR compression causes thickened crust; igneous rocks form as batholiths OR volcanoes (regional) metamorphism takes place	2	ALLOW destructive any two points
	Total	13	

Question			Answer	Marks	Guidance								
4	(a)	(i)	<table border="1"> <thead> <tr> <th>term</th> <th>definition</th> </tr> </thead> <tbody> <tr> <td>dip</td> <td>the maximum angle of inclination of a rock surface from the horizontal</td> </tr> <tr> <td>strike</td> <td>a horizontal line on a surface</td> </tr> <tr> <td>bed</td> <td>a layer of sedimentary rock with a thickness greater than 1 cm</td> </tr> </tbody> </table>	term	definition	dip	the maximum angle of inclination of a rock surface from the horizontal	strike	a horizontal line on a surface	bed	a layer of sedimentary rock with a thickness greater than 1 cm	2	2 correct = 1 3 correct = 2
		term	definition										
dip	the maximum angle of inclination of a rock surface from the horizontal												
strike	a horizontal line on a surface												
bed	a layer of sedimentary rock with a thickness greater than 1 cm												
(ii)	<p>strike: uses the compass to measure the strike direction AND</p> <p>dip: use a clinometer to measure the dip</p> <p>OR</p> <p>using a compass-clinometer to measure the strike and dip at 90° to each other</p>	1	allow a wide range of alternative wordings need to mention both strike and dip										
	(b)	(i)	<p>A <u>step</u> faults OR normal faults</p> <p>B <u>reverse</u> fault</p>	1	need both correct for 1 mark								
		(ii)	<p>A tensional</p> <p>B compressional OR compressive</p>	1	DO NOT ALLOW extensional ALLOW tension OR compression need both correct for 1 mark								

Question		Answer	Marks	Guidance
	(c)	horst: upthrown block drawn between two faults graben: downthrown block between two faults	1 1	upthrow and downthrow needs to be labelled OR arrows used AND a marker bed max 1 if correct diagrams but incorrect or no labels
	(d)	(i)		any one point
		(i)	1	
		(ii)	1	
		(ii)	1	ALLOW parasitic folding
	(e)	(i)	1	ACCEPT an arrow pointing at the unconformity
		(ii)	1	need deposition, folding, erosion and younger rocks for 1 mark
			Total	12

Question			Answer	Marks	Guidance
5	(a)	(i)	<p>The graph plots surface temperature (°C) against planets. The y-axis ranges from -200 to 500 in increments of 100. The x-axis lists Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus, and Neptune. The data points are approximately: Mercury (150), Venus (460), Earth (10), Mars (-60), Jupiter (-110), Saturn (-170), Uranus (-210), and Neptune (-220). A handwritten note 'Anomalous' points to the Venus data point.</p>	2	line not required points plotted to $\pm \frac{1}{2}$ square 5 correct points = 1 mark 8 correct points = 2 marks
	(b)		Venus OR Mercury	1	must be clearly labelled on the graph
	(c)		the closer to the Sun the higher the surface temperature/ ORA	1	
Total				4	

Question	Answer	Marks	Guidance
6	<p>P waves description</p> <ul style="list-style-type: none"> • P wave shadow zone is from $103^{\circ} - 142^{\circ}$ (can be shown on a diagram) • P waves travel through the outer (and inner) core • P waves refracted at outer core/mantle OR Gutenberg discontinuity OR outer core/inner core boundary OR Lehman discontinuity • P waves speed up in the inner core OR Lehman discontinuity <p>S waves</p> <ul style="list-style-type: none"> • S wave shadow zone $103^{\circ} - 103^{\circ}$ (can be shown on a diagram) • S waves stop at the outer core OR Gutenberg discontinuity • S waves occur in the inner core <p>Explanation</p> <ul style="list-style-type: none"> • P waves velocity controlled by incompressibility, rigidity and density (any 2) • S wave velocity controlled by rigidity and density • Outer core is liquid as S waves stop <u>and</u> P waves slow down OR refracted • Inner core is solid as S waves are propagated OR P waves speed up <p>Inner core starts at 5100 km (+/- 100km) and Outer core is 2900 km</p>	<p>max 2</p> <p>max 2</p> <p>max 3</p> <p>1</p>	<p>ALLOW +/- 3° P wave shadow zones must show angles if on a diagram</p> <p>ecf max 1 if P and S wrong way round</p> <p>ALLOW +/- 3° S wave shadow zones must show angles if on a diagram</p> <p>ecf max 1 if P and S wrong way round</p> <p>ecf max 1 if P and S wrong way round</p>
	Total	8	

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