OCR
RECOGNISING ACHIEVEMENT

GCE

Geology

Advanced Subsidiary GCE

Unit **F791:** Global Tectonics

Mark Scheme for June 2011

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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.

OCR will not enter into any discussion or correspondence in connection with this mark scheme.

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<table>
<tr><th colspan="3">Question</th><th>Expected Answers</th><th>Marks</th><th>Additional Guidance</th></tr>
<tr><td>1</td><td>(a)</td><td>(i)</td><td>drilling / borehole
cores of rock brought to the surface / deepest about 11 km / brings up igneous or metamorphic rocks from depth
(geological) mapping / collecting surface samples
mapping the outcrops of rock / collecting igneous or metamorphic or sedimentary rocks
mining
observing rocks at depth in mines / deepest mine about 4 km
volcanic eruptions
crustal rocks brought up in eruptions / fragments from volcanic vent or magma chamber
ophiolites
crust obducted / oceanic crust on land / ooze or chert, basalt, dolerite or gabbro (2 of the 4)</td><td>2</td><td>1 for name of method and 1 for extra detail
Allow 8 – 13 km
allow +/- 1 km on depth

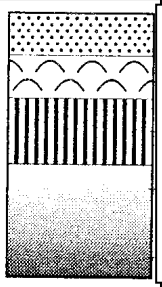
allow a named rock if appropriate

only allow 1 name and detail
allow 3 – 5 km
if an appropriate analytical technique described = 1</td></tr>
<tr><td></td><td></td><td>(ii)</td><td>mantle xenoliths
<u>peridotite</u> brought to the surface in volcanic eruptions
ophiolites
<u>peridotite</u> sometimes found at the base of ophiolites / part of the upper mantle
kimberlite pipes
bring up xenoliths from the mantle / from up to 250 km depth / peridotite or ultramafic rock</td><td>2</td><td>1 for name of method and 1 for extra detail

only allow 1 name and detail</td></tr>
<tr><td></td><td>(b)</td><td>(i)</td><td>
<table>
<tr><th></th><th>age of the oldest rocks</th><th>average comp</th><th>average thickness (km)</th><th>density g/cm^3</th></tr>
<tr><td>oceanic</td><td>200 Ma</td><td>mafic / basic / basaltic</td><td>7 km</td><td>2.9 +/- 0.1</td></tr>
<tr><td>continental</td><td>3700 - 4300 Ma</td><td>silicic / intermediate</td><td>35 km +/- 5 km</td><td>2.7</td></tr>
</table>
</td><td>4</td><td>allow basalt or dolerite or gabbro

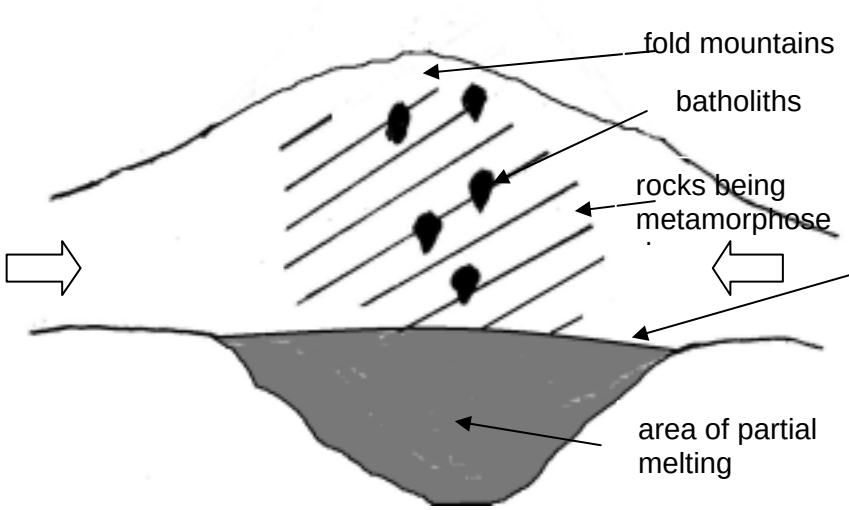
don’t accept a range for averages

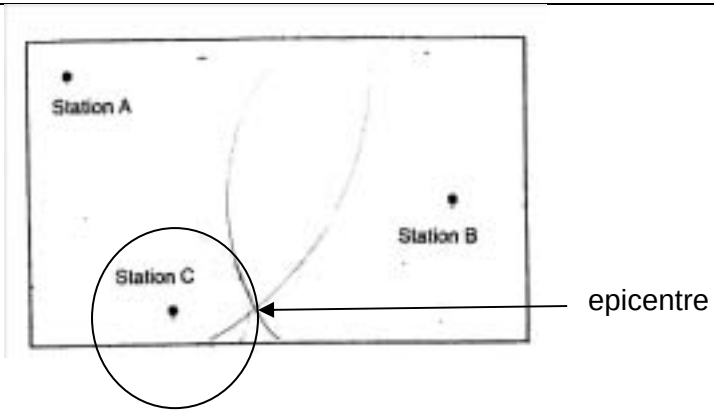
1 for each correct answer</td></tr>
</table>

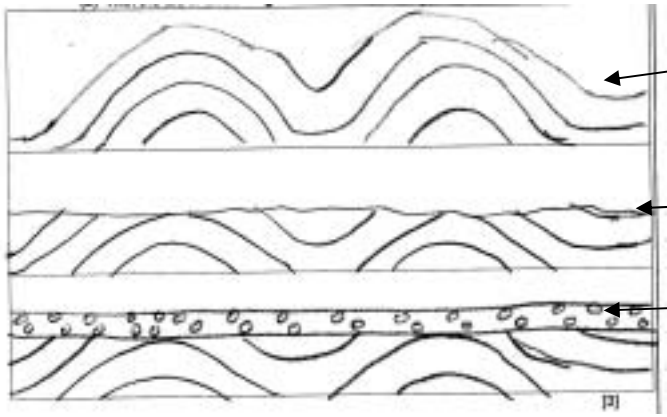
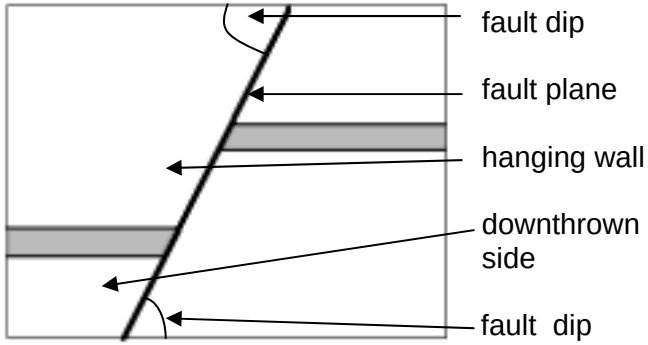
Question			Expected Answers	Marks	Additional Guidance
		(ii)	 sediment / ooze / chert basalt / pillow lavas dolerite / dykes gabbro	2	allow pillow lavas instead of basalt 1 - 2 correct labels = 1 mark 3 – 4 correct labels = 2 marks does not need to have symbols just labels
			Total	**10**	

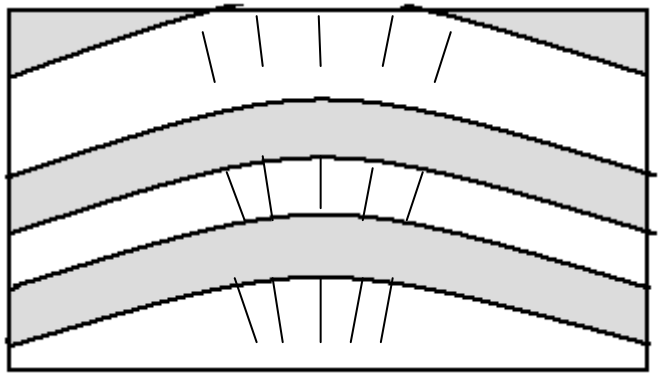
Question			Expected Answers	Marks	Additional Guidance
2	(a)	(i)	landings on Mars and Venus / mapped using radar Mariner spacecraft / Mars orbiter missions / probes / orbiting spacecraft fly-bys of Jupiter spotted volcanism on Io / photographs of the surface evidence from telescopes such as Hubble / land based satellite photographs of volcanoes	2	Accept infra red / thermal imaging if linked to Io, Triton or Encelodus any 2
		(ii)	Io	1	
		(iii)	Asteroid Belt	1	needs the correct spelling ignore capitals
			Total	**4**	

Question			Expected Answers	Marks	Additional Guidance
3	(a)	(i)	ridge push due to rising magma / rising magma pushes plates apart / seafloor spreading / rising magma at MOR forces crust apart / intrusion of dykes	1	allow general description of rising magma forcing its way through fractures allow diagram if annotated appropriately must indicate a force
		(ii)	subducting plate pulls rest of plate behind / sinking plate pulls rest of plate behind / gravity pulls the plate down	1	allow diagram if annotated appropriately do not accept just “slab pull” but needs an explanation must link to the plate
		(iii)	high heat flow / positive gravity anomaly / magma from upper mantle / eruptions of lava / volcanic eruptions / highest temperature at centre of MOR	1	do not accept hot spots
		(iv)	because older crust has subducted / older crust is denser so subducts / it has all been destroyed / has been recycled	1	
	(b)		shape of the MOR axial rift in the centre / linear mountain range symmetrical pattern any 2 high heat flow at the MOR due to volcanic activity / rising hot convection currents symmetrical pattern / parallel to MOR any 2 gravity (anomaly) high at MOR due to mountain range / elevated land symmetrical pattern any 2 transform faults / pattern of earthquakes earthquakes parallel to MOR / along transform faults shallow focus any 2 age of oceanic crust increases away from MOR / ora new crust formed at MOR age of crust symmetrical about the MOR any 2		allow 2 pairs of answers accept well annotated diagrams

Question			Expected Answers	Marks	Additional Guidance
			thickness of oceanic crust / sediment increases away from MOR / ora thicker sediment due to longer time to accumulate / ora thickness of crust or sediment symmetrical about the MOR any 2 magnetic stripes parallel to MOR magnetic stripes symmetrical about the MOR explanation of how rocks gain magnetism at MOR any 2	max 4	
	(c)	(i)		4	fold mountains must go up like a mountain range batholiths should be well below the surface rocks being metamorphosed could also be around a batholiths or in area of partial melting straight line but do allow a curved line (800°C) arrows must converge 1 correct = 1 mark 2-3 correct = 2 marks 4 correct = 3 marks 5 correct = 4 marks max 2 if subduction zone shown
		(ii)	Himalayas / Karakoram	1	
		(iii)	reverse / thrust	1	
		(iv)	ophiolite(s)	1	must have the correct spelling, but allow ophiiolite
			Total	**15**	

<table>
<tr><th colspan="3">Question</th><th>Expected Answers</th><th>Marks</th><th>Additional Guidance</th></tr>
<tr><td>4</td><td>a</td><td></td><td>
<table>
<tr><td></td><td>P wave arrival time</td><td>S wave arrival time</td></tr>
<tr><td>seismogram A</td><td>6</td><td>10</td></tr>
<tr><td>seismogram B</td><td>4.5</td><td>6.5</td></tr>
<tr><td>seismogram C</td><td>1.5</td><td>3.0 / 3.5</td></tr>
</table>
</td><td>2</td><td>1-2 correct = 1
3-4 correct = 2</td></tr>
<tr><td></td><td>b</td><td>ii</td><td>B = 2250 (km) (4.5 x 500)
C = 750 (km) (1.5 x 500)</td><td>1
1</td><td>allow ecf from (i)</td></tr>
<tr><td></td><td>c</td><td>iii</td><td> 
</td><td>3</td><td>1 mark for 1 correct arc
2 marks for 3 correct arcs
1 mark for locating the epicentre / can be in the centre of a triangle
allow ecf from (ii)</td></tr>
<tr><td></td><td></td><td></td><td>Total</td><td>7</td><td></td></tr>
</table>

Question			Expected Answers	Marks	Additional Guidance
5	(a)		overfold horst dome recumbent fold	4	1 for each correct answer
	(b)		 rocks folded / tilted rocks eroded younger rocks deposited on erosion surface	3	max 2 if only 1 or no diagram (need 2 or more) needs both the diagram and a brief explanation for each mark
	(c)	(i)	 fault dip fault plane hanging wall downthrown side fault dip	4	fault dip must be the acute angle 1 mark for each correct label
		(ii)	<u>normal</u> fault	1	dip slip fault is not sufficient

Question			Expected Answers	Marks	Additional Guidance
	(d)	(i)		1	make sure that the joints are in the sandstone (white beds) need to be some joints at the hinge needs to be at least 3 correct joints if in shale as well then no mark if only at base of bed then = 0
		(ii)	in the sandstone as it is a competent bed / brittle at the hinge / crest where tension or stretching is occurring	any 1	need a location and a reason
		(iii)	cooling joints / columnar joints / hexagonal joints as the magma cools the rock contracts / rock to fractures into hexagonal or polygonal shapes / tension causes cracks or joints / steady / uniform cooling	1 1	accept a labelled diagram showing contraction in hexagons
			Total	**16**	

Question			Expected Answers	Marks	Additional Guidance
6			**fit of the continents** fit along the coastlines / jigsaw fit of continents / between East coast of South America and West coast of Africa edge of continental shelf / 500m / 1000m / 2000m / on continental slope few overlaps due to younger rock deposited few gaps due to erosion	 1 1 1 1	only allow if mentioned in text only allow once mark diagrams as text if mentions erosion or deposition affects the fit then = 1 max 3
			rock types rocks have same characteristics / types / matching sequences (across the join) same age of rocks (across the join) example – (Precambrian) cratons example (Carboniferous) glacial deposits / tillites example – evaporate sequences	 1 1 1	mark diagrams as text max 3
			mountain chains / mountain belts same trend of mountain belts across the join of the continents structures such as folds / faults match up same rock types in the mountain belt across the join same age of mountains across the join	 1 1 1 1	mark diagrams as text max 3
			Fossils outcrops of fossils match up / same fossils on different continents fossils that could not have crossed an ocean the same on both continents / could cross when joined eg reptiles / *Mesosaurus* / *Cynognathus* / *Lystrosaurus* eg plants / *Glossopteris* trilobite provinces	 1 1 1 1 1	mark diagrams as text Scottish and N. American trilobites v English and Scandinavian trilobites max 3

Question			Expected Answers	Marks	Additional Guidance
			Glaciations direction of striations shows movement of ice / striations match up erratics on both continents glacial rocks match up across the join Carboniferous ice sheet across Gondwanaland / at poles together	 1 1 1 max 3	mark diagrams as text
			palaeoclimate / sedimentary rock types glacial deposits suggest proximity to poles coal deposits indicate equatorial conditions desert sandstones or evaporates suggest arid tropical conditions coral limestones suggest equatorial eg Britain has drifted from glacial conditions through equator, tropics to glacial conditions again / or other relevant example	 1 1 1 1 1 max 3	mark diagrams as text
			palaeomagnetism inclination of magnetic minerals is related to palaeolatitude at time of formation pole positions can be calculated from the data polar wandering curves can be plotted poles have remained in same places – it's the continents which have wandered 2 polar wandering curves coincide indicates continents together / when diverge so do the continents	 1 1 1 1 1 max 3	mark diagrams as text
					need 3 examples. if more than 3 given then take the best 3 marks
			Total	**8**	

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