

Mark Scheme for June 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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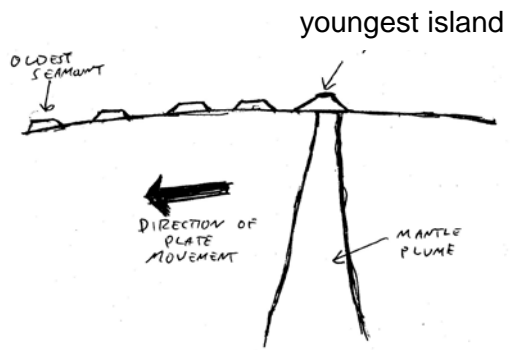
Annotations

| Annotation | Meaning |
|---|--|
|  | Unclear |
|  | Benefit of doubt given |
|  | Contradiction |
|  | Incorrect response |
|  | Error carried forward |
|  | Ignore |
|  | Benefit of doubt not given |
|  | Poor diagram |
|  | Reject |
|  | Noted, but no credit given |
|  | Correct response |
|  | Omission mark |
|  | Maximum (marks available for) Response |
| 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 |

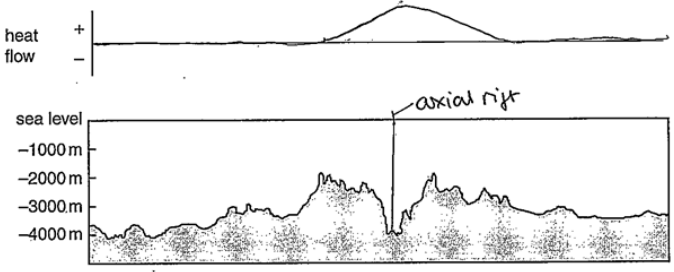
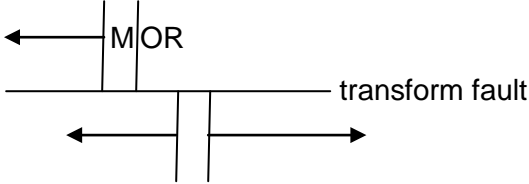
| Annotation | Meaning |
|-------------------|--|
| — | Underlined words must be present in answer to score a mark |
| ECF | Error carried forward |
| AW | Alternative wording |
| ORA | Or reverse argument |

| Question | | Answer | Marks | Guidance |
|----------|---------|---|------------|---|
| 1 | (a) | convergent OR destructive OR oceanic - oceanic crust | 1 | DO NOT ALLOW subduction zone or oceanic – continental crust |
| | (b) (i) | <u>energy</u> released OR magnitude | 1 | DO NOT ALLOW power OR strength OR amplitude |
| | (ii) | (amount of) damage OR earthquake <u>intensity</u> | 1 | DO NOT ALLOW effects |
| | (iii) | Isoseismal (lines) OR isoseismals | 1 | spelling needs to be completely correct |
| | (c) (i) | the earthquake was at shallow depth below the sea OR the earthquake was just below the sea floor OR the earthquake epicentre / focus was under the sea OR (the earthquake) <u>displaced</u> the sea floor OR (the earthquake) caused the sea floor to move (the sea bed movement) displaced a huge volume of water OR sudden movement sets up a large wave | 1 1 | the first point must put the event below the sea OR ocean crust OR underwater OR large body of water ALLOW fault movement of the sea floor DO NOT ALLOW plate movement answers must have a term meaning large scale |
| | (ii) | social many people may die impacting on families; people migrate OR are evacuated OR affected by food/water shortages OR people may be affected by disease; (fear of) increased cancer risk due to nuclear fallout; homes OR schools OR buildings OR roads destroyed; many people injured; economic loss of power supply OR damage to power lines OR damage to power plants OR damage to pipes ; increase gas prices; businesses collapse; agricultural land damaged by salt water OR agricultural yields reduced by salt; homes OR schools OR buildings OR roads destroyed; rebuilding costs; | 1 1 | ALLOW any reasonable answer. buildings destroyed can be in either section but only allow once DO NOT ALLOW infrastructure |

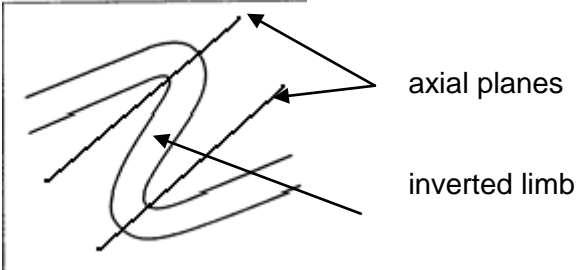
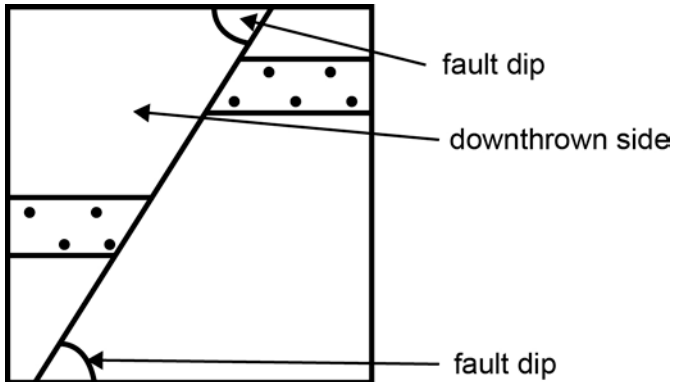
| Question | | Answer | Marks | Guidance |
|----------|---------|--|-----------|---|
| | (d) (i) | the ground vibrates/shakes and so behaves like a liquid OR the ground vibrates/shakes and so loses strength OR ground vibrates/shakes and so loss of shear strength OR ground vibrates/shakes and so the particles of unconsolidated sediment separate and are surrounded by water OR ground vibrates/shakes and so pore pressure rises OR the ground vibrates and water rises up through it. | 1 | must link ground vibrating or shaking with the effect |
| | (ii) | structures sink OR tilt OR break apart OR collapse OR slide OR foundations fail OR unstable OR foundations are undermined OR foundations crack due to differential movement | 1 | ALLOW subsidence |
| | | Total | 10 | |

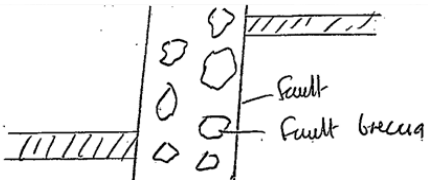
| Question | | | Answer | Marks | Guidance |
|----------|-----|-------|--|-------------------|--|
| 2 | (a) | (i) | where hot material meets the surface | 1 | must be at the surface |
| | | (ii) | <p><u>3D</u> images of heat flow;</p> <p>seismic waves change velocity when they travel through material of a different temperature OR different density OR different rigidity OR different incompressibility OR different compressibility;</p> <p>reveals areas of high heat flow compared to cooler;</p> | any 1 | <p>not just at plate boundaries</p> <p>ALLOW seismic waves change with density plus example</p> <p>allow higher as a comparison term</p> |
| | | (iii) | <div style="text-align: center;">  </div> <p>3 correct labels = 1 4 correct labels = 2</p> <p>volcanic activity creates an island OR rising magma creates an island; plate moves over the hotspot OR mantle plume; the mantle plume is stationary; older island sinks OR eroded OR volcano is extinct;</p> | <p>2</p> <p>1</p> | <p>if the diagram is not a cross-section max mark is 1</p> <p>up to 2 marks for the diagram and labels</p> <p>1 mark for 2 out of the 4 statements correct</p> |

| Question | | Answer | Marks | Guidance |
|--------------|---------|--|----------|---|
| | (b) (i) | volcanic activity brings up material from a great depth OR the mantle; by ripping/picking up rocks from the sides of the pipe OR the mantle OR 2500 m; contains diamonds which formed under high pressure; material brought up from the mantle is silicate rock OR peridotite OR mafic rich rock OR ultramafic rock OR same composition as stony meteorites; | 2 | any two points ALLOW eruptions |
| | (ii) | (mantle) <u>xenolith</u> | 1 | if xenolith not given then check under b (i) if used in the correct context |
| Total | | | 8 | |

| Question | | Answer | Marks | Guidance |
|----------|---------|--|--------|--|
| 3 | (a) (i) | labelled arrow in the valley in the centre of the diagram | 1 | must be clearly in lowest area or a vertical line drawn in the centre of the rift where there is a bracket it must not go beyond the two highest points must have a label |
| | (ii) | <p>rises directly above the axial rift of the MOR</p>  | 1 | peak of heat flow must be within the two highest points of the cross-section can have all of heat flow above background but must peak in the centre |
| | (iii) | high over the rift because of rising magma OR volcanic activity OR hot rising convection currents | 1 | |
| | (iv) |  <p>transform fault drawn at 90° to MOR and displacing MOR</p> <p>arrows to show plates diverging at 90° to the MOR OR (half) arrows to show relative movement along the transform faults OR magnetic stripes drawn and labelled which allow relative movement to be seen; earthquakes marked and labelled along a fault;</p> | 1 1 | <p>can just draw 1 transform fault but must be labelled as fault must have fault and MOR/rift labelled</p> <p>DO NOT ALLOW a cross-section diagram ALLOW a block diagram where the top can be marked up to 2 marks must displace the MOR If neither MOR or transform fault labelled then max 1 if diagram looks correct and arrows are correct</p> |

| Question | | Answer | Marks | Guidance |
|----------|-----|--|------------|---|
| | (v) | measure the changing distance between two points OR accurate measurements can be made across oceans to compare width over time OR measure changing position of a point over time | 1 | allow alternative wording ALLOW discussion of high heat flow seen at MOR (by thermal imaging cameras) by satellites |
| | (b) | distance/time $\frac{100 \times 1000 \times 4500}{150\,000\,000} = \frac{45}{15} = 3.0\text{cm/year}$ | 2 | 1 mark for correct method using distance/time 1 for correct answer ALLOW two marks for an accurate calculation of spreading – 1.5cm/year – on either side of MOR. |
| | (c) | away from plate margins OR it is in the middle of a plate OR no fault activity OR no tectonic activity | 1 | ALLOW little activity DO NOT ALLOW because it is aseismic |
| | (d) | ophiolites OR drilling/boreholes into the oceanic crust layers of sediment, basalt/pillow lava, dolerite/dykes, gabbro, peridotite. | 1 1 | ALLOW 1 mark for drilling into the ocean crust to a depth of 7 – 12km as alternative ALLOW core samples as alternative to borehole need at least 3 of the layers in correct order for ophiolite and drilling (could be a labelled diagram) max 1 for dredging rocks from the ocean AND sediment/ooze OR basalt |
| | | Total | 11 | |

| Question | | Answer | Marks | Guidance | |
|----------|-----|---|---|--|---|
| 4 | (a) | (i) | synform OR syncline | 1 | need word spelled correctly |
| | | (ii) | youngest = C oldest = B | 1 | need both correct to gain the mark |
| | (b) | (i) | D = antiform OR anticline E = overfold F = recumbent fold OR isocline OR isoclinal | 1 1 1 | ALLOW symmetrical anticline for D |
| | | (ii) | structure F OR recumbent fold | 1 | ecf from b (i) if name of fold type given instead of letter F |
| | | (iii) |  | 1 1 | need both fold axial planes to be correct for 1 mark |
| | (c) |  | 2 | 1 mark for each feature drawn in correct position and labelled ALLOW downthrow mark where no beds are drawn only if land surface and movement arrows shown can be either of the two possible fault dip positions, the label can be "angle of dip" or a specific value if a reverse drawn fault then max 1 if both labels are correct | |

| Question | | Answer | Marks | Guidance |
|----------|---------|--|-------|--|
| | (d) (i) | scratch marks OR grooves OR ridges OR striations; marks which feel smooth in the direction of movement and rough opposite OR mineralisation on one fault surface showing grooves OR polished; parallel; | 1 | no marks if linked to glaciers 2 descriptive points are needed for 1 mark |
| | (ii) | form as the two sides of the fault plane grind past each other; scratch marks OR grooves OR ridges OR striations form parallel to the direction of movement; steps form at 90° to movement; projections from the fault surface cause scratch marks OR grooves OR ridges OR striations; friction between two sides of the fault polishes the surface; | 1 | answers must include movement between fault surfaces DO NOT ALLOW plate movement instead of fault movement |
| (e) | (i) | diagram of fractured rock between two fault planes any 2 labels from: fault (plane); (angular) fragments; breccia; matrix OR cement; arrows showing movement  | 1 | drawing must show a fault zone (2 straight lines enclosing the breccia) fragments must be mainly angular or sub-angular |

| Question | | Answer | Marks | Guidance |
|----------|------|---|-----------|----------------|
| | (ii) | <p>fault movement OR forms due to pressure between fault planes OR between competent rocks OR between irregular fault surfaces.</p> <p>rocks fractured OR broken OR fragmented OR brecciated OR rock fragments rotated OR form angular fragments OR fragments joined together by matrix OR fragments joined together by minerals;</p> | 1 | needs 2 points |
| | | Total | 14 | |

| Question | | | Answer | Marks | Guidance |
|----------|-----|------|--|-------|--|
| 5 | (a) | (i) | fragment of rock <u>from space</u> that has fallen to Earth OR a solid piece of debris <u>from</u> outer <u>space</u> now on Earth OR rocks that fall to Earth <u>from space</u> OR a stony / metallic mass that has fallen to the Earth's surface <u>from space</u> ; | 1 | AW ALLOW from asteroid belt OR elsewhere in the solar system OR extra-terrestrial |
| | | (ii) | craters; shocked quartz OR spherules OR tektites; fractured OR brecciated rock OR rim of rock thrown up around the crater edge OR ejected material; tilted rock strata OR inverted strata; iridium (anomaly) OR rare earth metals; (stony or metallic) meteorite fragments; | 3 | any three points |
| | (b) | (i) | outer layer of the Earth OR crust and uppermost/top part of the mantle OR crust and uppermost/top part of upper mantle; above the asthenosphere; high geothermal gradient OR 10 – 15°C/km; solid OR rigid OR brittle; made of igneous, metamorphic and sedimentary rocks; low temperature OR cold; forms tectonic plates; P and S waves gradually speed up with depth; thickness average 100 km +/- 10 km; density 2.7 to 3.3 g/cm ³ ; | 2 | any two points DO NOT ALLOW crust and the upper mantle |

| Question | | Answer | Marks | Guidance |
|----------|-------|--|----------|--|
| | (ii) | flows OR rheid OR plastic; (5%) partially molten; part of the upper mantle; low geothermal gradient OR 1 – 2P°C/km; below the lithosphere; made of peridotite; > 1200 °C; P and S waves slow down OR low velocity layer OR less rigid; depth 75 – 250 km; density >3.3 g/cm ³ ; | 2 | any two points ALLOW moves slowly |
| | (iii) | flowing / ductile / rheid / plastic asthenosphere causes plates to move OR allows movement of convection currents | 1 | DO NOT ALLOW ridge push OR slab pull |
| | | Total | 9 | |

| Question | Answer | Marks | Guidance |
|----------|--|----------|---|
| 6 | <p>Processes <u>partial</u> melting of oceanic crust (1) description of subduction (1) rising magma OR diapirs linked to batholiths OR volcanoes (1) folding OR faulting linked to compression OR shortening (1) (regional/contact) metamorphism (1) orogenesis (1) slab pull OR sinking convection currents (1)</p> <p>Features <u>deep sea</u> trench OR <u>ocean</u> trench (1) Benioff zone or description (1) negative gravity anomalies over trench OR positive over volcanic mountains (1) low heat flow over trench OR high over volcanoes (1) ophiolites (or description) (1)</p> <p>reverse OR thrust faults OR nappe (1) named folds form (1) fold mountains (1) paired metamorphic belts OR metamorphic zones OR two named metamorphic rocks (1) explosive OR intermediate volcanoes OR andesitic volcanoes OR silicic volcanoes OR rhyolitic OR stratovolcanoes OR composite volcano (1) batholiths with detail (1) accretionary prism OR wedge (or description) (1)</p> | | <p>subduction mark can be given for an annotated diagram</p> <p>max 5 marks for processes</p> <p>The feature must be <u>described</u> for one mark. If only listed, then two listed points required for one mark</p> <p>DO NOT ALLOW just fold</p> <p>Detail: granite, gabbro, diorite, slow cooling, plutonic max 5 marks for features.</p> |
| | Total | 8 | |

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