GCE A LEVEL MARKING SCHEME

SUMMER 2022

A LEVEL
GEOLOGY – COMPONENT 3
A480U30-1

INTRODUCTION

This marking scheme was used by WJEC for the 2022 examination. It was finalised after detailed discussion at examiners' conferences by all the examiners involved in the assessment. The conference was held shortly after the paper was taken so that reference could be made to the full range of candidates' responses, with photocopied scripts forming the basis of discussion. The aim of the conference was to ensure that the marking scheme was interpreted and applied in the same way by all examiners.

It is hoped that this information will be of assistance to centres but it is recognised at the same time that, without the benefit of participation in the examiners' conference, teachers may have different views on certain matters of detail or interpretation.

WJEC regrets that it cannot enter into any discussion or correspondence about this marking scheme.

GCE A LEVEL GEOLOGY

COMPONENT 3 - GEOLOGICAL APPLICATIONS

SUMMER 2022 MARK SCHEME

Instructions for examiners of A Level Geology when applying the mark scheme

1 Positive marking

It should be remembered that candidates are writing under examination conditions and credit should be given for what the candidate writes, rather than adopting the approach of penalising him/her for any omissions. It should be possible for a very good response to achieve full marks and a very poor one to achieve zero marks. Worthwhile answers that meet the requirements of the question, but do not appear on the mark scheme are to be given credit.

2 Tick marking

Low tariff questions should be marked using a points-based system. Each credit worthy response should be ticked in red pen. The number of ticks must equal the mark awarded for the sub-question. The mark scheme should be applied precisely using the marking details box as a guide to the responses that are acceptable. Do not use crosses to indicate answers that are incorrect.

3 Annotated diagrams

Where a candidate has answered a question wholly or partly by use of an annotated diagram, credit must be awarded to the annotations which form credit-worthy responses as outlined in the marking details box. Candidates must be credited only once for valid responses which appear both as annotations to diagrams and within a section of prose in the answer to the same question.

4. Banded mark schemes

Banded mark schemes are divided so that each band has a relevant descriptor. The descriptor for the band provides a description of the performance level for that band. Each band contains marks. Examiners should first read and annotate a learner's answer to pick out the evidence that is being assessed in that question. **Do not use ticks** on the candidate's response. Once the annotation is complete, the mark scheme can be applied. This is done as a two-stage process.

Stage 1 – Deciding on the band

When deciding on a band, the answer should be viewed holistically. Beginning at the lowest band, examiners should look at the learner's answer and check whether it matches the descriptor for that band. Examiners should look at the descriptor for that band and see if it matches the qualities shown in the learner's answer. If the descriptor at the lowest band is satisfied, examiners should move up to the next band and repeat this process for each band until the descriptor matches the answer.

If an answer covers different aspects of different bands within the mark scheme, a 'best fit' approach should be adopted to decide on the band and then the learner's response should be used to decide on the mark within the band. For instance if a response is mainly in band 2 but with a limited amount of band 3 content, the answer would be placed in band 2, but the mark awarded would be close to the top of band 2 as a result of the band 3 content.

Examiners should not seek to mark candidates down as a result of small omissions in minor areas of an answer.

Stage 2 – Deciding on the mark

Once the band has been decided, examiners can then assign a mark. During standardising (marking conference), detailed advice from the Principal Examiner on the qualities of each mark band will be given. Examiners will then receive examples of answers in each mark band that have been awarded a mark by the Principal Examiner. Examiners should mark the examples and compare their marks with those of the Principal Examiner.

When marking, examiners can use these examples to decide whether a learner's response is of a superior, inferior or comparable standard to the example. Examiners are reminded of the need to revisit the answer as they apply the mark scheme in order to confirm that the band and the mark allocated is appropriate to the response provided.

Indicative content is also provided for banded mark schemes. Indicative content is not exhaustive, and any other valid points must be credited. In order to reach the highest bands of the mark scheme a learner need not cover all of the points mentioned in the indicative content but must meet the requirements of the highest mark band. Where a response is not creditworthy, that is contains nothing of any significance to the mark scheme, or where no response has been provided, no marks should be awarded.

Section A

Question			Marking details	Marks Available					
				AO1	AO2	AO3	Total	Maths	Prac
1	(a)	(i)	370 km (accept answer in range: 340-400 km) (1)	**1**			**1**	**1**	**1**
		(ii)	$\frac{370}{3.9}$ = (1) ecf from Q1ai 95 secs (expect answer in range: 87 to 103s) (1)		**2**		**2**	**2**	**2**
		(iii)	**Any three x (1) from** • plate margin/boundary • convergent/subduction • large **magnitude** of earthquakes • Mexico City built on unconsolidated sediment • amplification of waves • liquefaction • mass movement/subsidence other reasonable answers (do not credit LIC type answers)		**3**		**3**		

Question			Marking details	Marks Available					
				AO1	AO2	AO3	Total	Maths	Prac
	(b)	(i)	**Any two x (1) from:** • greater amplitude at A • longer duration at A • lower frequency/longer wavelength at A	**2**			**2**		
		(ii)	**Any two x (1) from:** **Description** • as clay gets thicker number of damaged buildings increases / positive correlation • only has an effect in thicker clay • damage to buildings is levelling out in the thickest clay • credit use of values **Any three x (1) from:** **Explanation** • liquefaction of sediment • explanation of liquefaction • clays weaker than solid bedrock • greater ground shaking / amplitude in thicker clay +(1) for development **MAX (4)**	**4**			**4**		

Question			Marking details	Marks Available					
				AO1	AO2	AO3	Total	Maths	Prac
	(c)		**Any three x (1) from:** • height of buildings does have an effect • effect of resonance on building • quality of building construction / building regulations is an important factor • Fig 1c shows taller buildings less affected • aseismic building design may reduce the effect of ground shaking • deep pile foundation may resist liquefaction • many buildings on thick clay deposits don't collapse • other factors such as ground acceleration may cause damage (+1) for development			**3**	**3**	**1**	**3**
			Question 1 total	**7**	**5**	**3**	**15**	**4**	**6**

Question			Marking details	Marks Available					
				AO1	AO2	AO3	Total	Maths	Prac
2	(a)	(i)	Increased risk of lung disease/lung cancer (1)	**1**			**1**		
		(ii)	**Any two x (1) from:** • radioactive decay • of uranium • in granite	**2**			**2**		
	(b)	(i)	$2.5 \times 10^{-2} = k \times 1.0 \left(\frac{210-110}{2000}\right)$ credit '210-110' (1) (accept 220-200 and 120-100) divide by 2000 (1) (accept 1900-2100) $k = 0.5$ or 5×10^{-1} (1) or accept a correct rearrangement of the equation		**3**		**3**	**3**	**3**
		(ii)	**Any four x (1) from:** • radon is soluble in groundwater • exsolves into empty pore space/fractures • moves with groundwater • dilution with distance from the source • at X the weathered granite has moderate permeability / is fractured • it is higher at Y because of high permeability of sandstone • it is lowest at Z because clay is impermeable • readings highest where there is pathway to surface / reference to the fault • reference to hydraulic conductivity result (+1) for development		**4**		**4**		

Question			Marking details	Marks Available					
				AO1	AO2	AO3	Total	Maths	Prac
	(c)	(i)	**Any three x (1) from:** • microfractures in rock • open when stress is applied to rock • radon gas is released / increase in radon emission • may be related to imminent earthquake as stress increases • does not indicate when fault may move	**3**			**3**		
		(ii)	**Any two x (1) from:** **ONE of** • <u>ground levelling & surveying</u> • measuring deformation of ground • looking for patterns of changing altitude across an area • EDM and GPS techniques • satellite remote sensing. +(1) for development **OR** • <u>ground deformation</u> • measuring small changes in relative position of places • creep meter • strain meter • tilt meter +(1) for development **OR** • <u>seismic **activity**</u> • foreshocks • changes in frequency of earthquakes • seismic gap • reduction in P-wave velocity +(1) for development	**2**			**2**		

Question			Marking details	Marks Available					
				AO1	AO2	AO3	Total	Maths	Prac
			OR • <u>electrical resistivity</u> • microfractures in rock • change when stress is applied to rock • water occupies cracks when they open • resistivity is reduced prior to earthquake **OR** • <u>groundwater levels/pressure</u> • microfractures in rock • change when stress is applied to rock • water occupies cracks • water levels change +(1) for development						
			Question 2 total	**8**	**7**	**0**	**15**	**3**	**3**

Section B

Question			Marking details	Marks Available					
				AO1	AO2	AO3	Total	Maths	Prac
3	(a)		**303570 –** Alluvium (1) River (fluvial) deposition (1) **330555 –** Head (1)	**3**			**3**		
	(b)		Landslide- Youngest Head Ashover Grit– Oldest (3 correct = 2 marks, 1 correct = 1 mark)			**2**	**2**		
			Question 3 total	**3**	**0**	**2**	**5**	**0**	**0**

Question			Marking details	Marks Available					
				AO1	AO2	AO3	Total	Maths	Prac
4	(a)		**Any three x (1) from:** Locate the fossil location onto a base map using • approximate distances (by measurement or pacing) • direction - bearings using a compass. • from prominent landscape features. • draw a line on the map along the edge of the compass from the landmark. (The fossil location is along this line). • a bearing is taken to a second landmark • the fossil location at the point where the lines meet on the map. Credit other sensible points e.g. triangulation			**3**	**3**		**3**
	(b)	(i)	Coral (1) **Any one x (1) from:** • septa • other sensible e.g. radial structure, ref to other named coral body parts	**2**			**2**		
		(ii)	**Any three x (1) from:** • warm (25-29 °C) • marine (normal salinity) • shallow (1–10 metres) • clear water • aerated water (turbulent) / high energy	**3**			**3**		

Question			Marking details	Marks Available					
				AO1	AO2	AO3	Total	Maths	Prac
		(iii)	**Any three x (1) from:** • head formed under cold conditions, but coral indicates warm • head terrestrial but coral marine • head is a younger/coral is older • the coral is in an included fragment in the head • the coral is a derived fossil • coral is derived from limestone +1 for development		**3**		**3**		**3**
			Question 4 total	**5**	**3**	**3**	**11**	**0**	**6**

Question			Marking details	Marks Available					
				AO1	AO2	AO3	Total	Maths	Prac
5	(a)	(i)	Antiform – beds dip away from the APT (1) Anticline – oldest beds in the centre (1) Plunge – outcrop patterns close towards the N/NNE (1)		**3**		**3**		
		(ii)	Plunging to SSW (top box) (1) Plunge to NNW (bottom box) (1)		**2**		**2**		
		(iii)	Incorrect because **Any two x (1) from:** • only half wavelength measured • only measured crest – trough • actual wavelength = approx. 1.2-1.7 km			**2**	**2**		**2**
	(b)	(i)	X (1) **Any two x (1) from:** • normal fault in SW • reverse fault in NE • Refer to why others are incorrect (2 max).		**3**		**3**		**3**
		(ii)	**Any three x (1) from:** • reverse fault by compression • normal fault by tension • faults perpendicular to the axis of the folds therefore different principal stress directions • folds approx. E-W compression • reverse fault NE-SW compression			**3**	**3**		**3**
			Question 5 total	**0**	**8**	**5**	**13**	**0**	**8**

Question			Marking details	Marks Available					
				AO1	AO2	AO3	Total	Maths	Prac
6	(a)	(i)	14 correctly plotted	**1**			**1**	**1**	**1**
		(ii)	-7 (1) Correct follow through (49 & 3.50) (1) Follow through error (1max)		**2**		**2**	**2**	**2**
		(iii)	19 is **greater** than (1) critical value (of 18.48 or ref to 7 DF) (1)		**2**		**2**	**2**	**2**
		(iv)	**Any two x (1) from:** • graph suggests a subjective preferred orientation • statistics give objective view if this data is significant • statistics enables us to quantify likelihood that the data occurred by chance • credit reference to recognition of / effects of anomalies		**2**		**2**		
	(b)		**Any three x (1) from:** • water in cracks expands by 9% on freezing • **repetition** of freeze-thaw cycles • cracks widen / weakens rock • slopes unstable above the critical angle • clasts/materials transported by gravity / a named process downslope	**3**			**3**		

Question			Marking details	Marks Available					
				AO1	AO2	AO3	Total	Maths	Prac
	(c)		**Max 6 marks - to include max 2 marks from a min 3 influencing factors:** 1. Dip angle and direction of the bedrock (max 2 marks). • probably no effect • dip angles are small, less than critical angle • dips generally NE (except one (A)) – landslides to SW and East /(2 dip into slope, 1 daylights) / A daylights to SW 2. Rock type of the bedrock • competent/permeable sst (ASG) overlying shales – allows water to percolate into the shale (spring) • Bowland shale – interbedded with less competent/impermeable siltstone and mudstone – weak. (needs more than just stating 'there is shale') • particularly when affected by water percolating from above 3. River erosion. • prominent NW-SE River Derwent (and tributaries) • constant undercutting • increasing slope angle of valley sides • affecting two landslides (A & B) but C inconclusive 4. The formation of the superficial Head deposit. • landslide C associated with Head • not landslides A and B			**6**	**6**		**6**
			Question 6 total	**4**	**6**	**6**	**16**	**5**	**11**

Section C Option 1 Quaternary Geology

Question			Marking details	Marks Available					
				AO1	AO2	AO3	Total	Maths	Prac
7	(a)	(i)	**Any two x (1) from:** • decreased • use of numbers • fluctuates/non-linear	**2**			**2**		**2**
		(ii)	**Any two x (1) from:** • oxygen isotopes preserved in shells of microfossils • **ratio** of isotopes varies with temperature • higher ^{18}O:^{16}O = colder • proxy for sea temperature	**2**			**2**		
	(b)	(i)	**Any three x (1) from:** • North America & Europe separated • ocean circulation to the North Atlantic • Antarctica & South America separated • Drake's Passage opens • current can flow around Antarctica • North & South America joined / Panama gap closes • stops water flow between Atlantic & Pacific • change in current in Mediterranean	**3**			**3**		
		(ii)	**Any two x (1) from:** • no transfer of warm water from tropics in Atlantic • water circulates around Antarctica • cold water restricted to Antarctica		**2**		**2**		

Question			Marking details	Marks Available					
				AO1	AO2	AO3	Total	Maths	Prac
		(iii)	**Any three x (1) from:** • increased temperature • transfer of heat from tropics • as Atlantic opens + (1) for development e.g. Gulf Stream/North Atlantic Drift		**3**		**3**		
			Question 7 total	**7**	**5**	**0**	**12**	**0**	**2**

Question			Marking details	Marks Available					
				AO1	AO2	AO3	Total	Maths	Prac
8	(a)		**Any one x (1) from:** • area covered with ice • high altitude of site • no trees/plants/organic matter at this site		**1**		**1**		
	(b)	(i)	**Any two x (1) from:** • Juniper reaches maximum at the base of the sequence / sudden appearance • rapid decline/replacement by other species/decline of Juniper • sediment beneath is glacial/clay (1)		**2**		**2**		
		(ii)	**Any three x (1) from:** • decrease/disappearance of juniper • high birch (2 & 3) • decrease in birch (4) • increase of hazel • reference to oak/pine +(1) for any use of numbers	**3**			**3**		
		(iii)	**Any two x (1) from:** • climate warmed • increase in tree cover • vegetation succession • alder out-competed other species			**2**	**2**		

Question			Marking details	Marks Available					
				AO1	AO2	AO3	Total	Maths	Prac
	(c)		**Any four x (1) from:** • pollen is more abundant • pollen is more easily preserved • vegetation communities are responsive to climatic change • more continuous record • shows community not individual species • pollen is widely distributed in wind • vertebrates fossilise infrequently • vertebrates only give “snapshot” of climatic conditions • both only give evidence from interglacials Credit other sensible answers			**4**	**4**		
			Question 8 total	**3**	**3**	**6**	**12**	**0**	**0**

Question			Marking details	Marks Available					
				AO1	AO2	AO3	Total	Maths	Prac
9			**Indicative content:** • The Quaternary is a very short period of geological time • Precision is required for a useful date for Quaternary events • Correlation can be difficult due to isolated interglacial deposits • Glacial erosion can interrupt sedimentary sequences • Use of varves is limited to proglacial lakes • Use of vertebrates as **zone fossils/for dating** limited by their low abundance and preservation • **Radiocarbon dating** can give accurate dates for organic material only • Short half-life, limits time range of dating to circa 50ka • Potential for contamination with ^{14}C in the environment • Lack of dating material during glaciations • **Dendrochronology** requires the finding of sufficiently large piece of wood to get a pattern of tree rings • The wood must be well-preserved • Requires a comparison to be made with a reference pattern of known age - limited to recent part of Quaternary • **Isochrons** from volcanic ash layers can be dated • Can only date the ash layer, not the specific event or fossil • Can cover the whole of Quaternary period • Greater uncertainty with K/Ar may be significant in Quaternary • Loss of argon from minerals leading to incorrect date • Relative dating can be applied to Quaternary sediments	**6**					

Question			Marking details	Marks Available					
				AO1	AO2	AO3	Total	Maths	Prac
			5-6 marks: A thorough understanding of how dating methods can be applied to the Quaternary to determine the age of deposits and events in the recent geological past. Knowledge of the limitations of **at least two** methods of dating. Discussion of how these limitations apply to the challenges of dating Quaternary materials. *The candidate constructs a relevant, coherent and logically structured account including all key elements of the indicative content. A sustained and substantiated line of reasoning is evident and scientific conventions and vocabulary are used accurately throughout.* **3-4 marks:** A sound understanding of how dating methods can be used to date deposits and events in the recent geological past. Knowledge of the limitations of **at least two** methods of dating. Supported by limited discussion of how these limitations apply to the challenges of dating Quaternary materials. *The candidate constructs a coherent account including many of the key elements of the indicative content and little irrelevant material. Some reasoning is evident in the linking of key points and use of scientific conventions and vocabulary is generally sound.*						

Question			Marking details	Marks Available					
				AO1	AO2	AO3	Total	Maths	Prac
			1-2 marks: A partial understanding of how dating methods can be used to date deposits and events in the recent geological past. Aware of the limitations of **at least one** method of dating Quaternary materials**.** Supported by generic examples of geological evidence. *Coherence is limited by omission and/or inclusion of irrelevant material. There is some evidence of appropriate use of scientific conventions and vocabulary.* **0 marks:** *The candidate does not make any attempt or give an answer worthy of credit.*						
			Question 9 total	**6**	**0**	**0**	**6**	**0**	**0**

Section C Option 2 Evolution of Britain

Question			Marking details	Marks Available					
				AO1	AO2	AO3	Total	Maths	Prac
10	(a)		**Any two x (1) from:** • waves reflect when properties of rock change • time taken for waves to travel to reflector • time taken to travel back to hydrophone • depth to reflector can be calculated	**2**			**2**		
	(b)	(i)	**Any two x (1) from:** • arid climate • hypersaline conditions • Britain at 30°N/desert latitudes • evaporation of sea water / evaporite • near continuous refilling of this part of the sea	**2**			**2**		
		(ii)	**Any two (x1) from:** • salt dome • low density salt • rises through more dense rock • diapirism • linked to faults	**2**			**2**		

Question			Marking details	Marks Available					
				AO1	AO2	AO3	Total	Maths	Prac
	(c)	(i)	*Tension (no mark)* **Any two x (1) from:** • divergent plate boundary • crustal extension • normal faults / hanging wall downthrown or equivalent • rift valley • horsts		**2**		**2**		
		(ii)	**Any three x (1) from:** • thickness of Upper Palaeogene sediments thicker in middle of section • faults don't extend far into Upper Palaeogene sediments • faults have less displacement in younger sediments • however, sediments could be infilling pre-existing basin • tectonic stress would decrease as Atlantic widened • tectonic stress may not have actually ceased • Palaeogene sediments may largely have been too ductile to fault, despite continued tensional stress • isostatic loading of water and sediment + (1) for development			**3**	**3**		
			Question 10 total	**6**	**2**	**3**	**11**	**0**	**0**

Question			Marking details	Marks Available					
				AO1	AO2	AO3	Total	Maths	Prac
11	(a)		Unconformity (1) Silurian cuts across bedding planes/faults (1)	**2**			**2**		
	(b)	(i)	K (1) (R) **Any two x (1) from:** • K is youngest fossil • fewest stipes • biserial stipe • most complex thecae • scandent		**3**		**3**		
		(ii)	**Any three x (1) from:** • shale = low energy / fine grained • well preserved fossils • black shale – anaerobic • fossils of pelagic organisms • graptolites are marine organisms • deposited in Iapetus Ocean		**3**		**3**		

Question			Marking details	Marks Available					
				AO1	AO2	AO3	Total	Maths	Prac
	(c)	(i)	Anticline (in black shales) or syncline (in pyroclastic deposits and black shales) marked in correct location (with NE-SW orientations) with symbol (1) Anticline – older rocks in core of fold (1) OR Syncline – younger rocks in core of fold (1)	**2**			**2**		
		(ii)	**Any three x (1) from:** • rocks affected are Ordovician in age • trend of fold axes is northeast-southwest • trend of major faults is northeast – southwest • rocks were deformed prior to Silurian • pyroclastic deposits indicate volcanic activity • sediments deposited in closing ocean • structures follow NE-SW Caledonian trend			**3**	**3**		
			Question 11 total	**4**	**6**	**3**	**13**	**0**	**0**

Question			Marking details	Marks Available					
				AO1	AO2	AO3	Total	Maths	Prac
12			**Indicative content:** • **Magnetic data** explained; vertical at poles and horizontal at Equator • Igneous rocks contain magnetite • Curie point - orientation of magnetisation of minerals in rocks aligned parallel to magnetic field at time of cooling - • Gives position of pole and angle of inclination to indicate latitude • Angle of inclination is different in rocks of different ages • Some sediments may show evidence of magnetisation • **Apparent polar wandering** - determination of position of magnetic pole at time of cooling (remanent magnetism) • Plotting positions of poles of different ages on a map and joining up points to produce an apparent polar wandering curve for a continent • Apparent as continent moves not pole (different continents have different polar wandering curves and there cannot have been several poles at same time) • Positions of pole relative to continent gives latitude of continent at a particular time and shows changes over time	**6**					

Question			Marking details	Marks Available					
				AO1	AO2	AO3	Total	Maths	Prac
			5-6 marks: A thorough understanding of how paleomagnetic evidence is preserved in rocks. Knowledge of the application of magnetic inclination **and/or** polar wandering to determine past positions of continents using palaeomagnetic evidence. Exemplification using the British geological record. *The candidate constructs a relevant, coherent and logically structured account including all key elements of the indicative content. A sustained and substantiated line of reasoning is evident and scientific conventions and vocabulary are used accurately throughout.* **3-4 marks:** A sound understanding of how palaeomagnetic evidence is preserved in rocks. Knowledge of the application of magnetic inclination **and/or** polar wandering to determine past positions of continents using palaeomagnetic evidence. There may be exemplification using the British geological record. *The candidate constructs a coherent account including many of the key elements of the indicative content and little irrelevant material. Some reasoning is evident in the linking of key points and use of scientific conventions and vocabulary is generally sound.*						

Question			Marking details	Marks Available					
				AO1	AO2	AO3	Total	Maths	Prac
			1-2 marks: A partial understanding of how palaeomagnetic evidence is preserved in rocks. There is some awareness of the application of either magnetic inclination or polar wandering to determine past positions of continents using palaeomagnetic evidence. The answer may be supported by generic examples of geological evidence. *Coherence is limited by omission and/or inclusion of irrelevant material. There is some evidence of appropriate use of scientific conventions and vocabulary.* **0 marks:** *The candidate does not make any attempt or give an answer worthy of credit.*						
			Question 12 total	**6**	**0**	**0**	**6**	**0**	**0**

Section C Option 3 Geology of the Lithosphere

Question			Marking details	Marks Available					
				AO1	AO2	AO3	Total	Maths	Prac
13	(a)		**Any three x (1) from:** • oldest in centre/youngest on margin • younger rocks in linear bands/ elongated zones • concentric pattern • surrounding a core • Palaeozoic on N/E/S, Mesozoic and Quaternary on west • use of numbers • other sensible	**3**			**3**		
	(b)		Ophiolite (1) Reference to obducted oceanic crust (1)	**2**			**2**		
	(c)		**Any three x (1) from:** • large volume / amount / area of lava • in a short period of time (~1 million years) • high flow rate • untypical of normal volcanics • basalt is a product of partial melting of the mantle		**3**		**3**		

Question			Marking details	Marks Available					
				AO1	AO2	AO3	Total	Maths	Prac
	(d)		**Any four x (1) from:** • at convergent margin /subduction • scraped off less dense rocks/obduction • onto continent/accretion • around an initial older core • closure of many oceans/orogenic belts/crustal shortening • from different directions/at different times • low density continental crust resists subduction • credit ref to mantle plume activity disrupting the pattern • credit ref to relevant part of the Wilson Cycle			**4**	**4**		
			Question 13 total	**5**	**3**	**4**	**12**	**0**	**0**

Question			Marking details	Marks Available					
				AO1	AO2	AO3	Total	Maths	Prac
14	(a)	(i)	~45 km (Range 40-50) (1)	**1**			**1**		**1**
		(ii)	Continental crust is thick (1) Made of granite (1)	**2**			**2**		
	(b)	(i)	**Any one x (1) from** • geotherm nowhere crosses the melting point curves • rock is not hot enough under these depth/pressures to partially melt	**1**			**1**		
		(ii)	Shading where: geotherm is hotter than the melting point curve in crust (1) geotherm is hotter than the melting point curve in mantle/ asthenosphere (1)		**2**		**2**		**2**
	(c)		**Any three x (1) from** • denser root to mountain • detaches from crust / delamination • sinks into less dense asthenosphere • less dense asthenosphere rises to fill its place		**3**		**3**		

Question			Marking details	Marks Available					
				AO1	AO2	AO3	Total	Maths	Prac
	(d)		**Any one x (1) from** • decrease in age towards the centre of the orogenic belt • use of numbers **Any two x (1) from** • delamination occurs at the lithosphere/asthenosphere boundary • first beneath the margin of the orogenic belt • later propagates to the crust as delamination of root progresses • decompression melting takes place where and when asthenosphere upwells	**1**		**2**	**3**		
			Question 14 total	**5**	**5**	**2**	**12**	**0**	**3**

Question			Marking details	Marks Available					
				AO1	AO2	AO3	Total	Maths	Prac
15			**Indicative content**: • understanding of how ocean basalts hold a record of palaeomagnetic events - Curie temp. • magnetic anomalies explained - normal and reversed fields • continental lavas provide evidence of magnetic field changes. • which can be radiometrically dated to provide a timescale • related to the pattern identified in ocean magnetic anomaly surveys • rate of plate movement is calculated from distance of the reversal/normal event from the ocean ridge over the time • (or reference to radiometric dating of dredged ocean basalts, or ocean sediments to give timescale). widening refers to the rate calculated on either side of the ocean ridge - per flank per year. **5-6 marks:** A thorough understanding of how ocean basalts hold a record of palaeomagnetic events. Reference made to continental lavas providing the magnetic reversal timescale and the link with the anomaly pattern identified in ocean magnetic surveys. Explanation of how the rate and direction of plate movement is calculated with understanding of ocean basin widening. Examples may be given. *The candidate constructs a relevant, coherent and logically structured account including all key elements of the indicative content. A sustained and substantiated line of reasoning is evident and scientific conventions and vocabulary are used accurately throughout.*	**6**			**6**		

Question			Marking details	Marks Available					
				AO1	AO2	AO3	Total	Maths	Prac
			3-4 marks: A sound understanding of how ocean basalts record palaeomagnetic events. Reference made to the magnetic timescale and the link to the anomaly pattern identified in ocean magnetic surveys. Explanation of how the rate of plate movement is calculated. Examples may be given. *The candidate constructs a coherent account including many of the key elements of the indicative content and little irrelevant material. Some reasoning is evident in the linking of key points and use of scientific conventions and vocabulary is generally sound.* **1-2 marks:** A partial understanding of palaeomagnetism in ocean basalts. Some reference to the magnetic reversal timescale with limited links to the ocean magnetic anomaly pattern. Simplified understanding of how the rate of plate movement is calculated with no reference to direction or ocean widening. Few or no examples given. *Coherence is limited by omission and/or inclusion of irrelevant material. There is some evidence of appropriate use of scientific conventions and vocabulary.* **0 marks:** *The candidate does not make any attempt or give an answer worthy of credit.*						
			Question 15 total	**6**	**0**	**0**	**6**	**0**	**0**