GCE A LEVEL MARKING SCHEME

SUMMER 2023

A LEVEL
GEOLOGY – COMPONENT 1
A480U10-1

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INTRODUCTION

This marking scheme was used by WJEC for the 2023 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.

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GCE A LEVEL GEOLOGY

COMPONENT 1 - GEOLOGICAL INVESTIGATIONS

SUMMER 2023 MARK SCHEME

Specimen B = Oolitic Limestone
Specimen C = Cornish Granite
Specimen K = Brachiopod

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.

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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 candidate'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 candidate'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 candidate'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 candidate'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 candidate'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 candidate 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.

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Question			Marking details	Marks Available					
				AO1	AO2	AO3	Total	Maths	Prac
1.	(a)	(i)	North American Plate to WNW (1) Eurasian Plate to ESE (1)		**2**		**2**		
		(ii)	1.4 – 1.7 km (1) 800 km^2 (1)	**1**	**1**		**2**	**2**	**2**
		(iii)	Lava at Hekla is andesitic, Lava at Katla is basaltic (1) **Any three x (1) from:** • lava at Hekla is more viscous than lava at Katla • lava at Hekla solidifies quicker than lava at Katla • lava at Katla is able to travel a long distance /lava at Hekla cannot travel a long distance • lava at Hekla has a higher SiO_2 content • lava at Hekla has a lower water content than Katla • basaltic lava erupts at higher temperature than andesitic lava • Hekla is a stratovolcano, Katla is a shield volcano		**4**		**4**		
	(b)	(i)	**Any two x (1) from:** • roof collapse • vehicle engine failure • loss of visibility • breathing difficulties • livestock/crop damage Credit sensible alternatives	**2**			**2**		

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Question			Marking details	Marks Available					
				AO1	AO2	AO3	Total	Maths	Prac
		(ii)	**Any one x (1) from:** • distance from volcanic cone • wind direction at time of eruption		**1**		**1**		
	(c)		**Any three x (1) from:** • water lowered the temperature of the lava • increasing the viscosity of the lava/solidifying the lava • reducing the speed of the lava/causing it to stop • lava was prevented from flowing further northwards		**3**		**3**		
	(d)		**Any two x (2) from:** • ground deformation/increase in slope angle suggests magma is moving up within the volcano • gravity anomalies/decrease in gravity suggests that solid rock is being replaced with liquid magma • thermal anomalies/increase in temperature suggests that magma is closer to the surface • gas emissions/increase in gas emissions suggests that magma is closer to the surface • seismic activity/increase in harmonic tremor suggests that volume of magma present is increasing **or** decrease in depth of focus suggests that magma is moving closer towards the surface • remote sensing/e.g. monitoring of gas emissions, thermal change, ground deformation Credit sensible alternatives	**4**			**4**		
			Question 1 total	**7**	**11**	**0**	**18**	**2**	**2**

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Question			Marking details	Marks Available					
				AO1	AO2	AO3	Total	Maths	Prac
2.	(a)		Plagioclase feldspar (1)	**1**			**1**	**1**	**1**
	(b)	(i)	A mineral which has a range of chemical compositions (1) Between two end members/Mg-Fe (1)	**2**			**2**		
		(ii)	**Any two x (1) from:** • Fe and Mg have the same positive charge • so that the molecule retains the same charge • both have similar ionic radii • so that they can 'fit into' the same crystal lattice		**2**		**2**		
	(c)		No marks for agreeing with the suggestion **Any three x (1) from:** • minerals with the lowest (or highest) melting point/crystallisation temperature • closest to (or furthest from) the temperature of the Earth's surface/most (or least) stable • are the most (or least) resistant to chemical weathering • relevant named mineral e.g. quartz (or olivine/plagioclase feldspar) • credit reference to effect of overlap of crystallisation temperatures • Figure 2a does not contain information about how susceptible the minerals are to hydrolysis/oxidation etc			**3**	**3**		

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Question			Marking details	Marks Available					
				AO1	AO2	AO3	Total	Maths	Prac
	(d)		Quartz does not weather/ weathers very slowly (1) Feldspar breaks down into clay/ions in solution (1) **Any two x (1) from:** • hydrolysis • chemical reaction of feldspar with water/acid • biological weathering credit reference to residual deposits e.g laterite, bauxite		**4**		**4**		
			Question 2 total	**3**	**6**	**3**	**12**	**1**	**1**

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Question			Marking details	Marks Available					
				AO1	AO2	AO3	Total	Maths	Prac
3.	(a)	(i)	<table><tr><td>Scratch with steel pin (1)</td><td>Mineral not scratched (1)</td></tr><tr><td>Observe reflected light (1)</td><td>Vitreous/glassy (1)</td></tr><tr><td>Observe parallel planes of weakness (1)</td><td>1 plane of cleavage (1)</td></tr></table>	**3**	**3**		**6**		**6**
		(ii)	Feldspar (1) Biotite mica (1)		**2**		**2**		**2**
	(b)	(i)	**Any two x (1) from:** • coarse crystal size/credit numerical values • porphyritic or equicrystalline • reference to crystal shape • random orientation	**2**			**2**		**2**
		(ii)	Cooled slowly/2 stages of cooling/phenocrysts cooled slowly/groundmass cooled quickly (1) At depth within the Earth/phenocrysts cooled at depth within the Earth/groundmass cooled at shallower depths or equivalent/ order of crystallisation of phenocrysts and groundmass (1)		**2**		**2**		**2**
			Question 3 total	**5**	**7**	**0**	**12**	**0**	**12**

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Question			Marking details	Marks Available					
				AO1	AO2	AO3	Total	Maths	Prac
4.	(a)	(i)	160°- 340° to 170°- 350° (1)		**1**		**1**	**1**	**1**
		(ii)	Dominant direction is 120°-180°/ 300°- 360°/(1) Least common direction 045°- 090°/ 225°- 270°(1) **or** accept compass directions below Dominant direction is NW/NNW/N to SE/SSE/S (1) Least common direction is SW/W to NE/E (1)	**2**			**2**	**2**	**2**
	(b)	(i)	16 (1) 6, 36, 3.6 (1) allow ecf if not 16 in the O column		**2**		**2**	**2**	**2**
		(ii)	Reference to 11.07 (1) Chi-squared value (11.2) is greater than 11.07/the critical value (1)			**2**	**2**	**2**	**2**
	(c)		**Any three x (1) from:** • phenocrysts at Location 2 show more alignment of orientation than those at Location 1/Location 1 shows no significant alignment • Location 1 is at the edge of the pluton/ Location 2 is in the middle • Location 2 would have cooled slower/Location 1 faster which enabled them to become aligned by flow within the intrusion			**3**	**3**		**3**
			Question 4 total	**2**	**3**	**5**	**10**	**7**	**10**

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Question			Marking details	Marks Available					
				AO1	AO2	AO3	Total	Maths	Prac
5.	(a)		Calcite/calcium carbonate (1) **Any two x (1) from:** • grain size approximately 1mm • spherical / ooids/ well rounded • well-sorted	**3**			**3**	**1**	**3**
	(b)		Scale (1) Shape (1) Detail (2) e.g. foramen, ribs, growth lines, edge of brachial valve overlying the pedicle valve, crenulated margin.		**4**		**4**	**1**	**4**
	(c)		Brachiopod (1) **Any one x (1) from:** • reference to plane of symmetry • foramen • reference to inequivalve		**2**		**2**		
	(d)		Reference to uniformitarianism (1) **Environment: Tropical** Limestone/ooids so likely to be tropical (1) **Environment: Shallow** **Any one x (1) from:** • fossil is a filter feeder so shallow • ooids so waves/tidal currents present • limestone forms in shallow water • fossil has ribs which suggest high energy therefore shallow water			**4**	**4**		**4**

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Question			Marking details	Marks Available					
				AO1	AO2	AO3	Total	Maths	Prac
			Environment: Marine **Any one x (1) from:** • fossil is marine • limestone forms in marine environments **To gain the 3 environment marks**, must have **at least one** of the fossil marks						
	(e)		Greywacke (1) >15% clay (1)		**2**		**2**	**1**	**2**
			Question 5 total	**3**	**8**	**4**	**15**	**3**	**13**

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<table>
<tr><th colspan="3" rowspan="2">Question</th><th rowspan="2">Marking details</th><th colspan="6">Marks Available</th></tr>
<tr><th>AO1</th><th>AO2</th><th>AO3</th><th>Total</th><th>Maths</th><th>Prac</th></tr>
<tr><td>6.</td><td></td><td></td><td>Indicative content see table below

<table><tr><th>Observation suggested</th><th>Justification</th></tr><tr><td>Look for way-up structures such as cross-bedding/trace fossils in Rock Unit B or graded bedding/sole structures in Rock Unit E</td><td>Enable application of superposition for Rock Units B and E</td></tr><tr><td>Look for chilled margins within Rock Unit C</td><td>Enable nature and rel age of Rock Unit C to be deduced</td></tr><tr><td>Look for a metamorphic aureole around Rock Unit C</td><td>Enable nature and rel age of Rock Unit C to be deduced</td></tr><tr><td>Check dip amounts using (a clinometer) and dip directions (using a compass) of Rock Units B/E to see if measurement given on map is anomalous</td><td>Enable application of principle of superposition for Rock Units B and E</td></tr><tr><td>Look for included fragments of Rock Units B/E/A in C, or of Rock Unit C in B/E/A</td><td>Enable relative dating to be applied</td></tr><tr><td>Look for cross-cutting relationships between Rock Units B/E and C or Rock Unit C and A</td><td>Enable relative dating to be applied</td></tr><tr><td>Look for zone fossils within Rock Units A, B and E</td><td>Enable rock units A, B and E to be dated</td></tr><tr><td>Look for whether beds adjacent to C have been folded up by forceful intrusion</td><td>Enable relative dating to be applied</td></tr><tr><td>Look if Rock Unit A has been metamorphosed</td><td>Enable relative dating to be applied</td></tr></table></td><td></td><td></td><td>9</td><td>9</td><td></td><td>9</td></tr>
</table>

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Question			Marking details	Marks Available					
				AO1	AO2	AO3	Total	Maths	Prac
			7–9 marks The response is well-structured and justifies a range of observations/techniques to enable consideration of the relative ages **of Rock Units C to Rock Unit A**, **Rock Unit C relative to Rock Units B/E** and **Rock Unit B relative to Rock Unit E**. Reference is also made to where these observations should be directed. Most or all of the observations/techniques are well justified showing that the candidate has a clear rationale for most of the observations that have been proposed. *There is a sustained line of reasoning which is coherent, substantiated and logically structured. The information included in the response is relevant*. **4–6 marks** The response is quite well-structured and includes a range of observations/techniques to enable consideration of **two** of the relative ages of Rock Units C to Rock Unit A, Rock Unit C relative to Rock Units B/E and Rock Unit B relative to Rock Unit E. Reference is also made to where these observations should be directed. Many but not all of the observations are justified appropriately, showing that the candidate has a reasonable rationale for many of the observations/techniques that have been proposed. *There is a line of reasoning which is partially coherent, supported by some evidence and with some structure. Mainly relevant information is included but there may be some irrelevant information or minor errors.*						

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Question			Marking details	Marks Available					
				AO1	AO2	AO3	Total	Maths	Prac
			1–3 marks The response makes use of a few observations/techniques only with superficial comments with regards to the relative ages of Rock Units A/B/C and E. Justification for the observations is limited revealing that the candidate has a limited rationale for the observations/techniques proposed. *There is a basic line of reasoning which is not coherent, supported by limited evidence and with very little structure. There may be significant errors or the inclusion of much irrelevant information.* NB. max 3 if no reference to any of the rock units **0 marks** No attempt made or no response worthy of credit. No observations suggested.						
			Question 6 total	**0**	**0**	**9**	**9**	**0**	**9**

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Question			Marking details	Marks Available					
				AO1	AO2	AO3	Total	Maths	Prac
7.	(a)		Correct position of axial plane trace with anticline symbol (1) Correct offset of axial plane trace by F2 (1) Plunge to the North (1)		**3**		**3**		**3**
	(b)		Arrowhead in contact with base of D to the West of F1 (1)		**1**		**1**		**1**
	(c)	(i)	70 m (1) / / 90° or vertical (1) Reverse (1) / Strike-Slip (1) /Sinistral		**4**		**4**	**2**	**2**
		(ii)	F1 Hanging Wall has moved up or equivalent (1) F2 All boundaries have been offset in the same direction/no vertical displacement/core bed(H) same width (1)		**2**		**2**		
			Question 7 total	**0**	**10**	**0**	**10**	**2**	**6**

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Question			Marking details	Marks Available					
				AO1	AO2	AO3	Total	Maths	Prac
8.			Correct plot of bases of A and D near X and horizontal (1) Correct surface plot and dip direction of F/E to W of F1, and of E/B to E of F1 (1) Correct apparent dip angle (40° or less) of F/E to W of F1 and correct apparent dip angle (40° or less) of E/B to E of F1 (1) Correct plot of Fault F1 at 75 towards X (accept 70-80) (1) Correct plot of C and drawn discordant (1) Correct plot of base of A near Y and horizontal (1) Correct plot of base of E beneath the unconformity (1) Correct apparent dip angle (20° or less) of base of E beneath unconformity (1) APT in correct location (1) APT inclined dipping towards X (1) Projected Cross-Cut of E/F with base of D (1) E/F boundary correctly downthrown to the east of F1 (1) A/D boundary cut by C, to show C as one igneous body (1)		**1** **1** **1** **1** **1** **1** **1** **1** **1** **1** **1** **1**	**13**	**13**	**13**
			Question 8 total	**0**	**3**	**10**	**13**	**13**	**13**

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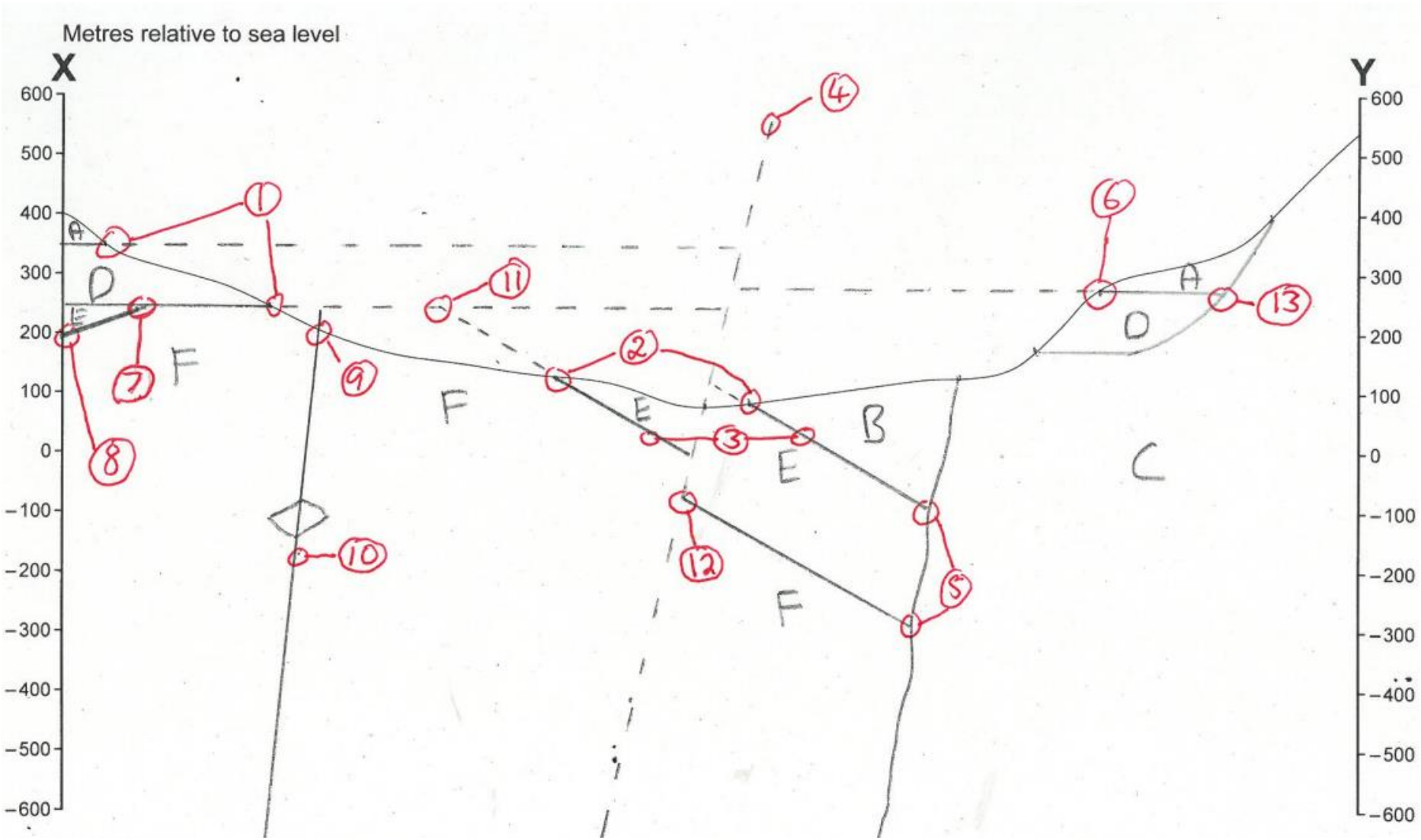

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Question			Marking details	Marks Available					
				AO1	AO2	AO3	Total	Maths	Prac
9.			**Indicative content:** (allow ecf from Q7) **3 episodes of deformation** Yes there are 3 different episodes of deformation (2 episodes of faulting and an episode of folding) Not all rocks have been subjected to all 3 episodes. Rock Units A and D faulted but not folded, but unknown if deformed by F2. Rock Unit C has been faulted by F2 and not folded, but unknown if deformed by F1. **Occurred at different times** Yes because: F2 cuts F1 F1 cuts the folds within G, B, E, F and H F2 has offset the Fold Axial Plane trace within H **Different types of stress** Yes for F1 and F2, F1 formed by compressive stress but F2 formed as a result of shear stress No for folds and F1, both formed by compressive stresses **Acting in the same direction** No as σ^{max} for F2 is acting ENE-WSW but σ^{max} for the folding and F1 is acting E-W	**0**	**0**	**6**	**6**	**0**	**6**

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Question			Marking details	Marks Available					
				AO1	AO2	AO3	Total	Maths	Prac
			5–6 marks There is a clear response which discusses at least **three** of **episodes, time, type** and **direction** of the stresses involved in the deformation. There are references to **F1, F2** and the **folding** which are described coherently. All judgements are consistent with the information as analysed. *There is a sustained line of reasoning which is coherent, substantiated and logically structured. The information included in the response is relevant.* **3–4 marks** There is a clear response which **discusses** at least **two** of **episodes**, **time, type** and **direction**. There are references to **two** of **F1, F2** and the **folding** which are described coherently Most judgements are drawn that are consistent with the information as analysed. *There is a line of reasoning which is partially coherent, supported by some evidence and with some structure. Mainly relevant information is included but there may be some irrelevant information or minor errors.* **1–2 marks** At least **one** of **episodes**, **time, type** and **direction** is discussed. There may be a lack of relevance in places and judgements drawn concerning **F1, F2** and the **folding** are superficial, with simple comments on the nature of the structures. *There is a basic line of reasoning which is not coherent, supported by limited evidence and with very little structure. There may be significant errors or the inclusion of much irrelevant information.* **0 marks** No attempt made or no response worthy of credit.						
			Question 9 total	**0**	**0**	**6**	**6**	**0**	**6**
			Paper Totals	**20**	**48**	**37**	**105**	**28**	**72**

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