GCE A LEVEL MARKING SCHEME

AUTUMN 2020

A LEVEL
GEOLOGY – COMPONENT 2
A480U20-1

INTRODUCTION

This marking scheme was used by WJEC for the 2020 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 2 - GEOLOGICAL PRINCIPLES AND PROCESSES

AUTUMN 2020 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.

Question			Marking details	Marks Available					
				AO1	AO2	AO3	Total	Maths	Prac
1	(a)	(i)	B (1) B (1) A (1)	**3**			**3**		
		(ii)	Brachiopod (1)	**1**			**1**		
		(iii)	Burrower (1R) **Any three x (1) from:** • presence of pallial sinus • for emergence of siphons • elongated shape • smooth valves		**4**		**4**		
	(b)	(i)	**Any three x (1) from:** • more fossils in population 1 • continuous record of fossils in population 1 • greater range in population 1 • mode of 2-3mm in population 1/26-27mm in population 2 • bimodal in population 1 • fewer specimens damaged in population 1 • exemplar values Accept vice versa for population 2.	**3**			**3**	**3**	**3**

Question			Marking details	Marks Available					
				AO1	AO2	AO3	Total	Maths	Prac
		(ii)	Student most likely correct (1R) **Any three x (1) from:** • lack of juveniles in sample 2 • gaps in sample 2 • fewer fossils in sample 2 • however, gaps may be natural/sampling error • fossils in sample 2 likely to have undergone transportation • more fossil damage/erosion in sample 2 • however, 40% not damaged/eroded • fossils in sample 2 better sorted Accept converse arguments			**4**	**4**		**4**
			Question 1 total	**7**	**4**	**4**	**15**	**3**	**7**

Question			Marking details	Marks Available					
				AO1	AO2	AO3	Total	Maths	Prac
2	(a)		An = 1560 ± 10 °C (1) Ab = 1125 ± 10 °C (1)	**2**			**2**	**2**	**2**
	(b)	(i)	K^+ and Na^+ have too different ionic radii (1) K^+ will not fit into the albite atomic lattice (1)		**2**		**2**		
		(ii)	**Any three x (1) from:** • Al and Si able to substitute for each other • Ca and Na able to substitute for each other • overall charge is balanced • $Al^{3+} + Ca^{2+} = Si^{4+} + Na^+$ • similar ionic radii • exemplar radii		**3**		**3**		
	(c)	(i)	29-30 % An (1) 55-55.5 SiO_2 (1) 1505-1515 °C (1)	**3**			**3**	**3**	**3**
		(ii)	Melt is more Na^+/Ab rich (1) Melt is more Ca^{2+}/An poor (1) Melt is more Si (silica) rich (1) Accept vice versa for crystals		**3**		**3**		

Question			Marking details	Marks Available					
				AO1	AO2	AO3	Total	Maths	Prac
	(d)		**Any four x (1) from:** • oceanic lithosphere includes mafic rocks • mafic rocks contain plagioclase feldspar • partial melting of anorthite-rich plagioclase can generate an andesitic (intermediate) melt • partial melting of anorthite-rich plagioclase can also however generate a basaltic (mafic) melt • assumes that melt does not react back with the solid crystals • mafic rocks also contain augite/olivine- no information on these minerals • oceanic lithosphere also includes ultramafic rocks • which may produce mafic melt Magma generated can also be influenced by: • contamination • mixing • fractional crystallisation			**4**	**4**		
			Question 2 total	**5**	**8**	**4**	**17**	**5**	**5**

Question			Marking details	Marks Available					
				AO1	AO2	AO3	Total	Maths	Prac
3	(a)	(i)	Line bisecting the muscovite-andalusite zones (1) Line bisecting the andalusite-sillimanite zones (1)	**2**			**2**		**2**
		(ii)	Labelled arrow pointing south towards granite pluton (1) **Any two x (1) from:** • grade increases towards granite pluton • sillimanite forms at higher temperatures		**2**		**2**		**2**
		(iii)	Metamorphic event predates deposition of sandstone (1) Therefore, sandstone not metamorphosed (1) Limestone is composed of calcium carbonate/does not contain Al &/or Si (1) Therefore, limestone is metamorphosed but the index minerals cannot form (1)			**4**	**4**		
		(iv)	**Any two x (1) from:** • limestone is jointed • enables heat loss by fluids/convection in limestone • this heat cannot metamorphose the limestone • therefore, narrower metamorphic aureole in limestone • shale better conductor of heat than limestone • therefore, wider metamorphic aureole in shale Accept vice versa		**2**		**2**		

Question			Marking details	Marks Available					
				AO1	AO2	AO3	Total	Maths	Prac
	(b)		**Indicative content** **Rock Types** X = Fault gouge Y = Fault breccia **Mode of formation** Metamorphism Dynamic Metamorphism Along strike-slip fault Shear deformation High localised (along fault plane) stress **Texture/composition** Fault gouge clear foliation Fault breccia cryptic foliation Ductile flow in fault gouge As incompetent rock Brittle shattering in fault breccia As competent rock Fault breccia cemented by calcite cement Mineralogy similar to parent rock Therefore, relatively low temperatures/shallow depths Clays susceptible to metamorphism Credit reference to mylonite at location X		**6**		**6**		**2**

Question			Marking details	Marks Available					
				AO1	AO2	AO3	Total	Maths	Prac
			5-6 marks There is a clear response which describes and explains in detail most of the processes involved in the formation of the fault gouge and fault breccia. This includes a thorough account of dynamic metamorphism and the contrasting ways in which both parent rocks have responded differently to stress. A logical sequence of the processes is clearly developed drawing upon evidence (map, texture and mineralogy) and then subsequent inference. *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** The response describes and explains how the texture (and composition) of the rock types is indicative of (dynamic) metamorphism having occurred. A brief description of this type of metamorphism is given but the different responses of the two rock types may be missing. A logical sequence of the processes is developed in places but not throughout. *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.*						

Question			Marking details	Marks Available					
				AO1	AO2	AO3	Total	Maths	Prac
			1-2 marks The response identifies the rock types and/or shows an awareness that (dynamic) metamorphism has occurred. There is a lack of detail in the response and comment is rather superficial. There may be a significant lack of relevance in places. *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 3 total	**2**	**10**	**4**	**16**	**0**	**6**

Question			Marking details	Marks Available					
				AO1	AO2	AO3	Total	Maths	Prac
4	(a)	(i)	**Any three x (1) from:** • sea level rose through Mesozoic • sea level fell through Cenozoic • superimposed higher frequency changes • exemplar values of sea-level	**3**			**3**	**3**	**3**
		(ii)	**Any two x (1) from:** • global temperatures low when ice age • water trapped in ice sheets • global sea level falls • cooling and contraction of water	**2**			**2**		

Question			Marking details	Marks Available					
				AO1	AO2	AO3	Total	Maths	Prac
	(b)		**Any two x (1) from:** Student is correct- • in Cenozoic where low global sea levels correspond to cold global temperatures • in Jurassic and Cretaceous where high global sea levels correspond to warm global temperatures • in Devonian and lower Carboniferous where high global sea levels correspond to warm global temperatures • in Cambrian and Ordovician where high global sea levels correspond to warm global temperatures **Any two x (1) from:** Student is incorrect- • in Triassic where low global sea levels correspond to warm global temperatures • in upper Carboniferous and Permian where high global sea levels correspond to cold global temperatures • in Silurian where high global sea levels correspond to cold global temperatures **Maximum of three marks**			**3**	**3**	**3**	**3**

Question			Marking details	Marks Available					
				AO1	AO2	AO3	Total	Maths	Prac
	(c)		Tethys ocean (1R) **Any two x (1) from:** • Atlantic Ocean is growing/wide • Atlantic Ocean has an ocean ridge • Atlantic Ocean has no subduction zone • Tethys Ocean is shrinking/narrow • Tethys Ocean has no ocean ridge • Tethys Ocean has a subduction zone		**3**		**3**		
	(d)	(i)	**Any two x (1) from:** • student is correct • in early Jurassic limited ocean ridge development and sea levels +50m compared to today • in late Cretaceous significant ocean ridge development and sea levels +120m compared to today			**2**	**2**		
		(ii)	**Any two x (1) from:** • ocean ridges elevated parts of ocean floor • displace ocean waters • onto land Credit other sensible responses	**2**			**2**		
			Question 4 total	**7**	**3**	**5**	**15**	**6**	**6**

Question			Marking details	Marks Available					
				AO1	AO2	AO3	Total	Maths	Prac
5	(a)		**Any two x (1) from:** • heft – gold feels heavier than magnetite • hardness – gold scratched by copper coin • magnetism – magnetite deflects compass needle Credit other reasonable answers	**2**			**2**		**2**
	(b)	(i)	**Any three x (1) from:** • high hardness – magnetite resistant to erosion • no cleavage – resistant to erosion • high density – separated from gangue minerals/concentrated into economic deposits • chemical composition – chemically inert		**3**		**3**		
		(ii)	Cassiterite (1)		**1**		**1**		
	(c)		**Indicative content** **Gravity** Used to prospect for minerals with high or low density Gold, cassiterite and magnetite have higher than normal densities Can be useful for ore bodies that may contain dense minerals e.g. gold Not useful for sphalerite Positive Bouguer anomalies		**6**		**6**		

Question			Marking details	Marks Available					
				AO1	AO2	AO3	Total	Maths	Prac
			Magnetic Used to prospect for minerals with high magnetic susceptibility Especially useful for iron-bearing minerals Especially useful for magnetite then cassiterite and possibly sphalerite Not useful for gold Positive magnetic anomalies **Electrical** Used to prospect for minerals with low electrical resistivity (high electrical conductivity) Especially useful for conducting minerals Especially useful for gold then magnetite then cassiterite/sphalerite Negative resistivity anomalies **Seismic** Used to outline size/shape of orebody As seismic waves reflect/refract from mineral horizons with high or low density Gold, cassiterite and magnetite have higher than normal densities; sphalerite less so						

Question			Marking details	Marks Available					
				AO1	AO2	AO3	Total	Maths	Prac
			5-6 marks There is a clear response which describes and explains in detail at least **three** geophysical prospecting techniques. This includes aspects particularly relevant to at least **three** ore minerals and an evaluation may be made of which technique is best suited to which mineral. Exemplar values are quoted from the table. A logical explanation of the relevance of each geophysical prospecting technique is made throughout. *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** The response describes and explains at least **two** geophysical prospecting techniques. This includes aspects particularly relevant to at least **two** ore minerals. Exemplar values may be quoted from the table. A logical explanation of the geophysical prospecting techniques is developed in places but not throughout. *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.*						

Question			Marking details	Marks Available					
				AO1	AO2	AO3	Total	Maths	Prac
			1-2 marks The response describes and partially explains just **one or two** geophysical prospecting techniques. This includes aspects particularly relevant to at least **one** ore mineral. There is a lack of detail in the response and comment is rather superficial. There may be a significant lack of relevance in places. *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 5 total	**2**	**10**	**0**	**12**	**0**	**2**

Question			Marking details	Marks Available					
				AO1	AO2	AO3	Total	Maths	Prac
6	(a)		Ocean trench labelled anywhere along convergent plate boundary (1) Transform fault labelled anywhere along conservative plate boundary (1) Deep focus earthquakes labelled within 1000km of north eastern edge of subduction zone (1)	**3**			**3**		
	(b)	(i)	Y = 2850 km (2750-2950 km)	**1**			**1**	**1**	**1**
		(ii)	Calculation of Cocos plate circumference (Candidates value for Y + 2280 + 1960 + 920) (1) (Candidates values for Y) / (Candidates value for Y + 2280 + 1960 + 920) or correct decimal value; 0.356 (1) Correct % value 35.6% (1)		**3**		**3**	**3**	**3**
	(c)	(i)	Point correctly plotted on Figure 6b (1) Point correctly plotted on Figure 6c (1)	**2**			**2**	**2**	**2**
		(ii)	No correlation between mean lithospheric plate speed and the total lithospheric plate area (1) Good/moderate (1) positive (1) correlation between mean lithospheric plate speed and the subduction zone length as a percentage of lithospheric plate circumference			**3**	**3**	**3**	**3**

Question			Marking details	Marks Available					
				AO1	AO2	AO3	Total	Maths	Prac
	(d)		**Any three x (1) from:** • slab pull depends on length of subducted plate • reasonably good degree of positive correlation between plate speed and the relative length of the subduction zone compared to the lithospheric plate circumference • indicates that slab pull is likely to be a major force in causing plate motion • however, data is not uniformly distributed • only really comparing plates with subduction zones versus those without			**3**	**3**		**3**
			Question 6 total	**6**	**3**	**6**	**15**	**9**	**12**
			Paper Totals	**29**	**38**	**23**	**90**	**23**	**38**