GCE A LEVEL MARKING SCHEME

SUMMER 2019

A LEVEL (NEW)
GEOLOGY - COMPONENT 2
A480U20-1

INTRODUCTION

This marking scheme was used by WJEC for the 2019 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

SUMMER 2019 MARK SCHEME

COMPONENT 2 - GEOLOGICAL PRINCIPLES AND PROCESSES

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)	**Any two x (1) from:** • Low precipitation = minimal depth of weathering • High precipitation = significant depth of weathering • Use of exemplar values	**2**			**2**		**2**
		(ii)	**Any three x (1) from:** • High rainfall / • Facilitates hydrolysis/carbonation/solution/oxidation • High temperature • Increases rate of reaction		**3**		**3**		
		(iii)	Temperate/periglacial (1) Availability of water for ice wedging (1) Temperatures straddle $0^{O}C$ for freezing of water (1)		**3**		**3**		
	(b)		**Any three x (1) from:** • Sedimentary rocks formed at/near Earth's surface • By weathering/erosion/deposition/diagenesis • Increasing burial/temperature/pressure/ • Forms metamorphic rocks • May partially melt rocks to form igneous rocks	**3**			**3**		
	(c)		**Any four x (1) from:** • Shales/mudstones made of clay minerals • Clay minerals formed by hydrolysis of feldspar • Residual quartz in sandstones as inert/insoluble/unaltered from the **parent rock** • Oxidation of the **parent rock** minerals can produce ions in solution • Carbonation of the **parent rock** minerals can produce ions in solution • Ions precipitate to form evaporites/limestones	**4**			**4**		
			Question 1 total	**9**	**6**	**0**	**15**	**0**	**2**

Question			Marking details	Marks Available					
				AO1	AO2	AO3	Total	Maths	Prac
2	(a)	(i)	Cretaceous (1) 6.5 million (1)	**2**			**2**	**0**	**2**
		(ii)	**Any three x (1) from:** • Evolved in the Precambrian • Rise into the Ordovician • Drop in Silurian • Essentially constant from Ordovician to Permian • Fall at P-T boundary • Rise from Jurassic to Recent • Fall at K-Pg boundary • Use of exemplar values	**3**			**3**	**0**	**3**
	(b)		**Any three x (1) from:** • Many species become extinct • Numbers quoted from graph for P-T mass extinction • Extinct forms include both marine and non-marine forms • Extinction happened in short period of time		**3**		**3**		

Question			Marking details	Marks Available					
				AO1	AO2	AO3	Total	Maths	Prac
	(c)		**Indicative content** **Timing of large scale volcanicity** Some mass extinction events correspond e.g. P-T mass extinction Some mass extinction events do not e.g. end Capitanian **Estimated volume of emitted lava** No inherent relationship Largest volume of lava does not correspond to mass extinction Largest mass extinction (P-T) has lower lava volume **Type of lithosphere** No mass extinction when erupted through oceanic lithosphere Mass extinction only when erupted through continental lithosphere **Age of continental lithosphere** No mass extinction when erupted through continental lithosphere < 2500 Ma Mass extinction only when erupted through continental lithosphere > 2500 Ma			**6**	**6**		

Question			Marking details	Marks Available					
				AO1	AO2	AO3	Total	Maths	Prac
			5–6 marks There is a clear response which evaluates the relationship between mass extinction events and **all four** of the prescribed aspects. Most or all of the evidence is interpreted competently. The relationship between the timing of volcanicity and mass extinctions is discussed and the lack of link with erupted volume of lava is made. The importance of lithosphere type and age is realised. Examples are quoted. *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 partially evaluates the relationship between mass extinction events and at least **three** of the prescribed aspects. Some of the evidence is interpreted coherently. Relationships may only be partially developed. *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 the relationship between mass extinction events and just **one or two** of the prescribed aspects. The evidence is discussed with only rather superficial comment and there is a 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 2 total	**5**	**3**	**6**	**14**	**0**	**5**

Question			Marking details	Marks Available					
				AO1	AO2	AO3	Total	Maths	Prac
3	(a)		Chlorite (1) Fine (1) Foliated/slaty cleavage (1)			**3**	**3**		**3**
	(b)	(i)	Arrow at junction between slate and metaquartzite (1)	**1**			**1**		
		(ii)	20-40^{o} (1) West/ 270^{o} (1)		**2**		**2**		**2**
		(iii)	**Any two x (1) from:** • Cleavage more evident in slate • Cleavage more closely spaced in slate • Cleavage dip angle more uniform in slate	**2**			**2**		
		(iv)	True thickness at X = 0.07-0.10 m (1) True thickness at hinge = 0.15-0.22 m (1)	**1**	**1**		**2**		**2**
		(v)	**Any two x (1) from:** • During folding/metamorphism • Ductile flow occurs • (Quartz) flows towards hinge/ away from centre of limb • Movement along cleavage planes • Original sedimentary bed was uneven thickness		**2**		**2**		
	(c)		Asymmetric: cannot tell as do not see both limb lengths (1) Overturned: correct as limbs or beds dip in same direction (1) Isoclinal: incorrect as ILA is 60-70^{o} not parallel limbs (1)			**3**	**3**		
			Question 3 total	**4**	**5**	**6**	**15**	**0**	**7**

Question			Marking details	Marks Available					
				AO1	AO2	AO3	Total	Maths	Prac
4	(a)		**Any three x (1) from:** • Rock salt is crystalline/sandstone is clastic • Sandstone is porous/rock salt lacks porosity • Sandstone has a cement/rock salt lacks a cement • Rock salt crystals >1mm/sandstone grains 0.1mm • Rock salt crystals more angular than quartz grains	**3**			**3**		**3**
	(b)	(i)	0.6-0.7 km (1) 1.0 km (1)	**2**			**2**		**2**
		(ii)	(2.3–1.9) / (4.0 – 0) (1) 0.1 - 0.1125 (1) gcm^{-3} km^{-1} (1)		**3**		**3**	**3**	
		(iii)	**Any three x (1) from:** • Rock salt lacks porosity • Rock salt does not undergo compaction • Sandstone loses porosity and becomes more dense • By diagenesis • By repacking • By cementation • By pressure solution		**3**		**3**		

Question			Marking details	Marks Available					
				AO1	AO2	AO3	Total	Maths	Prac
	(c)	(i)	Horizontal line in sandstone unit only, adjacent to salt dome (1) Horizontal line in sandstone unit at the crest of an antiform above the salt dome (1)			**2**	**2**		
		(ii)	**Any three x (1) from:** • Burial beneath **at least 1.3 km** • Salt becomes ductile/able to flow • Salt less dense than sandstone and shale • Salt becomes buoyant • Rises towards surface • Displacing/intruding/folding sandstone and shale • Eventually stops flowing		**3**		**3**		
			Question 4 total	**5**	**9**	**2**	**16**	**3**	**5**

Question			Marking details	Marks Available					
				AO1	AO2	AO3	Total	Maths	Prac
5	(a)	(i)	P, S and surface waves in that order (1) P= fastest; S= intermediate; surface waves= slowest; surface waves largest amplitude. Two statements needed (1)	**2**			**2**		
		(ii)	Between epicentre and epi-central angle 104^{o} (1) Does not enter P-wave or S-wave shadow zone (1)			**2**	**2**		
	(b)	(i)	**Any two x (1) from:** • Continually refracted/curved ray path from mantle to core boundary • Hits mantle-core boundary and refracts • Refracts towards normal • Hits mantle-core boundary and refracts • Refracts away from normal	**2**			**2**		
		(ii)	**Any three x (1) from:** • Enters liquid outer core • Enters denser material • Enters less rigid/compressible material • Wave speed reduces • Wave refracts towards normal • Earth's core acts as 'converging lens' • Waves refracted away from 104-140^{o} epi-central angles	**3**			**3**		
		(iii)	From epicentre to inner core boundary (1) From inner core boundary to Earth surface between epi-central angle of 104-140^{o} (1)		**2**		**2**		

Question			Marking details	Marks Available					
				AO1	AO2	AO3	Total	Maths	Prac
	(c)		3920 km (1) 3921.8 if significant figures not recognised **Any two x (1) from:** • 104^{o} divided by two = 52^{o} • Use of cosine (or sin of 38 ^{o}) • Cos 52 = x/6370 or similar		**3**		**3**	**3**	**3**
			Question 5 total	**7**	**5**	**2**	**14**	**3**	**3**

Question			Marking details	Marks Available					
				AO1	AO2	AO3	Total	Maths	Prac
6	(a)		**Any two x (1) from:** • As interval between eruptions increases so does silica content/positive correlation • Rate of increase of silica content decreases as eruption interval increases • Use of exemplar value		**2**		**2**	**2**	**2**
	(b)		**Indicative content** Partial/decompressional melting of mantle at plume/divergent plate boundary yields mafic/basalt lavas No basalts at Hekla Lavas at Hekla are intermediate/andesitic Usually this lava type forms during subduction of oceanic lithosphere Early-formed minerals in magma chamber are silica poor Early-formed minerals are denser than melt Gravity settling Remaining melt more silicic Greater time for fractionation, more silicic, the remaining melt is then erupted Possibility of magma contamination			**6**	**6**		

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 why the andesitic lavas at Hekla conflict with the model **and** how such lavas may arise through fractional crystallisation processes. Most of the steps involved in the formation of the secondary magma are outlined in a logical fashion. A realisation of how increased fractional crystallisation with time leads to a change in magma/lava composition is evident. *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 response which partially describes and explains why the andesitic lavas at Hekla conflict with the model **and** how such lavas may arise through fractional crystallisation processes. Some of the steps involved in the formation of the secondary magma are outlined although not in a detailed logical fashion. *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 partially describes why the andesitic lavas at Hekla do not fit with the model **or** how such lavas may arise through fractional crystallisation processes. No significant detail is given on the type of magma expected or erupted and/or the stages in the evolution of the secondary magma. *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						
	(c)	(i)	r_1 1981 = 8 and 1636 = 6 (1) r_2 1693 and 1597 = 2.5 (1)		**2**		**2**	**2**	**2**
		(ii)	1 – [(6 x 36.5) / (10^3 – 10)] (1) 0.78 (1)		**2**		**2**	**2**	**2**
		(iii)	**Any two x (1) from:** • Significant at the 95% level • Not significant at the 99% level • Can be more than 95% confident that the result did not occur by chance • Null hypothesis is rejected at 95% confidence level		**2**		**2**	**2**	**2**

Question			Marking details	Marks Available					
				AO1	AO2	AO3	Total	Maths	Prac
	(d)		larger eruption interval more magma accumulates in magma chamber (1) constant rate of addition of magma to magma chamber (1) or if null hypothesis not rejected no relationship between eruption interval and magma accumulation (1) non-uniform rate of addition of magma to magma chamber (1)		**2**		**2**		
			Question 6 total	**0**	**10**	**6**	**16**	**8**	**8**
			Paper Totals	**30**	**38**	**22**	**90**	**14**	**30**