GCE A LEVEL MARKING SCHEME

AUTUMN 2020

A LEVEL
GEOLOGY – COMPONENT 3
A480U30-1

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 3 - GEOLOGICAL APPLICATIONS

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.

Section A

Question			Marking details	Marks Available					
				AO1	AO2	AO3	Total	Maths	Prac
1	(a)		Epicentre located within the 6 EMS isoseismal line	1			1		
	(b)	(i)	**Any two x (1) from:** • decreases away from epicentre • not uniform • higher intensities further to the north or west of the epicentre • credit reference to 5 EMS anomaly	2			2		
		(ii)	**Any one x (2) from:** • local ground conditions explained • unconsolidated rock explained • liquefaction explained • other reasonable explained		2		2		
	(c)		**Any two x (2) from:** • seismic gap theory time explained • seismic gap theory space explained • foreshocks explained • change in p wave velocity explained	4			4		

Question			Marking details	Marks Available					
				AO1	AO2	AO3	Total	Maths	Prac
	(d)	(i)	$\frac{2}{3}\ log_{10}10^{23} - 10.7$ (1) correct application of BIDMAS (1) Max 2 marks if answer is 15.4 $M_W = 4.6$		3		3	3	3
		(ii)	**Any three x (1) from:** • recognition of low magnitude/intensity • little damage • repair damage • insurance • hazard mapping • risk assessment • securing objects to shelves • do nothing (+1) for development **Do not accept aseismic design, evacuation routes etc.**	3			3		
			Question 1 total	**10**	**5**	**0**	**15**	**3**	**3**

Question			Marking details	Marks Available					
				AO1	AO2	AO3	Total	Maths	Prac
2	(a)	(i)	**Any two x (1) from:** • dips gently • quantified, approx. 5° • to northwest	2			2		
		(ii)	**Any three x (1) from:** • dip direction out of slope • weak superficial deposits • impermeability of bedrock • steep slopes • incompetent mudstone	3			3		
	(b)		**Any four x (1) from:** • tip slopes are steeper • increased above friction angle • working of coal seam increases permeability • water flowing into base of tip • higher water table • increased pore water pressure • waste is unconsolidated			4	4		
	(c)		**Any one x (2) from:** • boreholes (1) to pump water to reduce water table (1) • reshaping tip profile (1) reduce slope angle (1) • retaining wall (1) to hold back material (1)	2	2		4		

Question			Marking details	Marks Available					
				AO1	AO2	AO3	Total	Maths	Prac
	(d)		**Any two x (1) from:** • explanation of piezometric surface • flooding • springs or • explanation of piezometric surface • ground swelling • pore-water pressure • weakens foundations		2		2		2
			Question 2 total	**7**	**4**	**4**	**15**	**0**	**2**

Section B

Question			Marking details	Marks Available					
				AO1	AO2	AO3	Total	Maths	Prac
3	(a)		Triassic cross-cuts Carboniferous (discordant) (1) Difference in dip (1)		2		2		2
	(b)	(i)	Angular (1) Poor (1)	2			2		2
		(ii)	**Any three x (1) from:** • poor sorting/angular grains of conglomerate • tongue/ V-shaped outcrops • on either side of the anticline (fold) • Carboniferous limestone included fragments			3	3		
	(c)	(i)	Rx = 5 and 12.5 Ry = 6 and 12.5 (4 correct = 2 marks, 2 correct = 1 mark)		2		2	2	2
		(ii)	$Ux = (10x10) + \frac{10(10+1)}{2} = 155 - 76.5 = 78.5$ (1) (1)		2		2	2	2
		(iii)	**Any two x (1) from:** • Uy = 21.5 is less than the critical value • the null hypothesis is rejected at 95% significance • there is a 95% probability that the roundness of the two facies is different		2		2	2	2

Question			Marking details	Marks Available					
				AO1	AO2	AO3	Total	Maths	Prac
	(d)		**Any three x (1) from:** Reference to transport amount • X greater (farther /longer) more rounded than Y Reference to transport agent • (X) fluvial - high energy flash floods • (Y) scree – gravity/mass movement deposit Reference to erosion • (X) more abrasion leading to clast rounding or • (Y) less abrasion – more angular, larger clasts. Reference to Mann-Whitney U • rejection of H_0 suggests different surface processes operating for X and Y			3	3		
			Question 3 total	**2**	**8**	**6**	**16**	**6**	**10**

Question			Marking details	Marks Available					
				AO1	AO2	AO3	Total	Maths	Prac
4	(a)	(i)	**Any two x (1) from:** • tick on downthrown side • younger rock on downthrow side • anticline limbs closer together on downthrow side		2		2		2
		(ii)	1.15 cm x 120 = 138m (accept 128m -148m) (1) (1)		2		2	2	2
	(b)		Biddle Fault cuts the Triassic (Dolomitic Conglomerate) (1) Stock Hill Fault pre-Triassic/ does not cut Triassic (1)			2	2		
			Question 4 total	**0**	**4**	**2**	**6**	**2**	**4**

Question			Marking details	Marks Available					
				AO1	AO2	AO3	Total	Maths	Prac
5	(a)		**Any one x (1) from:** • Lead (Pb) • Iron (Fe)	1			1		
	(b)	(i)	+ 3 N-S: Total 14 + 2 E-W: Total 30 + 2 SE-NW: Total 18 (2 marks for 3 correctly categorised and added; 1 mark for 2 correct)		2		2		2
		(ii)	Accuracy of plots (2 marks for 3 correct, 1 mark for 2) Mirror image of each sector plotted (1)	3			3	3	3
		(iii)	Veins in the Dolomitic Conglomerate (not just Carb Lst) (R) (1) **Max two x (1) from:** • veins on the steeper dipping northern limb • none on the gentler southern limb • some on gentle limb north of box A **Max two x (1) from:** • some E-W parallel to fold axis (Triassic) • some veins have different orientations (Carboniferous) **Max 4 marks in total**			4	4		
			Question 5 total	**4**	**2**	**4**	**10**	**3**	**5**

Question			Marking details	Marks Available					
				AO1	AO2	AO3	Total	Maths	Prac
6	(a)	(i)	**Any two x (1) from:** • pore spaces – absent, small, not connected • infilled by calcite cement • recrystallization during lithification • very poor sorting • angular grains	2			2		
		(ii)	**Any three x (1) from:** • joints, bedding planes, fractures • enlarged by percolating acidic waters (carbonation/solution) • to produce underground drainage pathways – caverns • secondary porosity		3		3		
	(b)	(i)	<u>3250m</u> (1) (accept 3100-3400) 27 (1) = ~120 mh^{-1}		2		2	2	2
		(ii)	**Any two x (1) from:** • rainfall amount/saturation • height of the water table • extraction from wells • lack of soil cover • seasonal variations		2		2		

Question			Marking details	Marks Available					
				AO1	AO2	AO3	Total	Maths	Prac
	(c)		**Any 4 x (1) (including max 2 from either section) from:** Mineral veins • least risk. • chemical weathering of veins is relatively slow but constant. • movement through rock is quick so no concentration • mineral veins in limestone mainly to the north of the anticline Contaminated ground • high risk. Potential for serious water pollution • no soil filter in quarries • movement of harmful pollutants will be very quick • with little time for natural filtration			4	4		
			Question 6 total	**2**	**7**	**4**	**13**	**2**	**2**

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:** • follows latitude 18ka, now SW-NE • in the west, 8°C isotherm moves very little • moves further in east than west • description involving moving North	2			2		
		(ii)	**Any two x (1) from:** • rise in temperature warms climate • ice does melt in winter • changes to interglacial • wetter in UK		2		2		
	(b)	(i)	**Any one x (1) from:** • climate warms slower in North America/quicker in Europe • climate warms earlier in North America/ later in Europe • larger temperature changes in Europe	1			1		1
		(ii)	11.2 - 10.2 ka		1		1		1

Question			Marking details	Marks Available					
				AO1	AO2	AO3	Total	Maths	Prac
		(iii)	**Any two x (1) from:** • till • moraines • erratics • drumlins • fluvioglacial deposits • glaciolacustrine deposits credit other sensible glacial deposits + (1) for each explanation	4			4		
			Question 7 total	**7**	**3**	**0**	**10**	**0**	**2**

Question			Marking details	Marks Available					
				AO1	AO2	AO3	Total	Maths	Prac
8	(a)	(i)	*Homo erectus* (1)	1			1		1
		(ii)	**Any two x (1) from:** • fluctuations in rainfall • over relatively short period of time • periodic volcanic activity • changing water levels		2		2		
	(b)	(i)	Correctly substituting values recognising daughter & parent isotopes (1) working (including application of BIDMAS) Max (2) if answer is $-1.2x10^{10}$ 0.902Ma (1)		3		3	3	3
		(ii)	**Any three x (1) from:** • hominin evolution takes place over millions of years • ^{14}C limited timescale • isochronous layer allows radiometric dating • correlation between different sites • cannot directly date sediments/fossils older than 50ka • Ar can become lost • K/Ar resolution not as accurate as ^{14}C			3	3		
	(c)	(i)	**Any two x (1) from:** • increase • non-linear • greater increase more recently	2			2		2

Question			Marking details	Marks Available					
				AO1	AO2	AO3	Total	Maths	Prac
		(ii)	**Any three x (1) from:** • greater variability of climate • selects organisms able to adapt • making tools to cope with changing conditions • communication between individuals		3		3		
			Question 8 total	**3**	**8**	**3**	**14**	**3**	**6**

Question			Marking details	Marks available					
				AO1	AO2	AO3	Total	Maths	Prac
9			**Indicative content** Eccentricity/Precession/Tilt - descriptions including diagrams Combination of these give greater effects at some times than others Effects on seasons Increases seasonal variation Cool winters and mild summers favour glacial growth Extreme seasonal variation restricts glacial growth Combined – effects on climate – can reduce impact of variation Cyclical nature of climate change Oxygen isotope data confirmed theory Confirmation came decades after its conception. Importance of changes at 60°N **5-6 marks** A thorough understanding of how Milankovitch Cycles can alter climate. Knowledge of the types of orbital variation and its impact on solar insolation. Effect of changes on seasonal variation. *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					

Question			Marking details	Marks available					
				AO1	AO2	AO3	Total	Maths	Prac
			3-4 marks A sound understanding of how Milankovitch Cycles can alter climates. Knowledge of the changing seasonality of caused by the cycles. Supported by limited evidence from the 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.* **1-2 marks** A partial understanding of Milankovitch Cycles. Aware of fluctuating climatic evidence**.** 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:** • dip slip • reverse fault • dips to SSW • angle of dip approx. 50° • hanging wall upthrown Any other sensible description of fault	2			2		
	(b)	(i)	180 – (85 + 72) 23°		2		2		2
		(ii)	Limbs have same strike (1) In plunging folds limbs do not have the same strike/the limbs are not parallel to each other in map view (or equivalent) (1)		2		2		
		(iii)	Variscan Orogeny (1) R **Any two x (1) from:** • located in Southern Britain • Carboniferous rocks folded • trend of folding			3	3		

Question			Marking details	Marks Available					
				AO1	AO2	AO3	Total	Maths	Prac
	(c)		**Any three x (1) from:** • change from marine to terrestrial sediments • oolitic limestone deposited in marine environment • breccia likely to be terrestrial • shale with roots deposited on land • erosive surface on top of limestone • return to marine conditions indicated by the Crinoidal Limestone with corals	3			3		
			Question 10 total	**5**	**4**	**3**	**12**	**0**	**2**

Question			Marking details	Marks Available					
				AO1	AO2	AO3	Total	Maths	Prac
11	(a)	(i)	Younger than gabbro (1) Older than dykes (1)	2			2		
		(ii)	Correctly substituting values recognising daughter & parent isotopes (1) Working (including application of BIDMAS) Max (2) if answer is -4.5×10^9 Answer: 53.3 Ma (1)		3		3	3	3
	(b)		Mafic magma (1) Partial melting of mantle lithosphere (1) Crustal tension (1) Intrusion of dyke swarm (1)		4		4		
	(c)		**Any three x (1) from:** • granite forms late in the igneous history of Skye • magma differentiation • partial melting of crust • contamination of magma • magma mixing	3			3		
			Question 11 total	**5**	**7**	**0**	**12**	**3**	**3**

Question			Marking details	Marks available					
				AO1	AO2	AO3	Total	Maths	Prac
12			**Indicative content** "*Snowball Earth*" theory. 660 -635 Ma Very rapid temperature changes. Extreme temperature changes Glaciation/Glacial debris deposited globally Coarse-grained dropstones fall from melting ice/icebergs In marine sediments Magnetic inclination indicates horizontal magnetic field Suggests sedimentation at the Equator Ice at Equator Cap carbonate interpreted as providing evidence of rapid changes in atmospheric greenhouse gases at the end of the Snowball Earth event. **5-6 marks** A thorough understanding of how a global glaciation may be caused and the impact it would have. Supported by examples from Britain (Port Askaig Tillite) and other locations (e.g. Namibia). Knowledge of palaeomagnetic evidence. *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					

Question			Marking details	Marks available					
				AO1	AO2	AO3	Total	Maths	Prac
			3-4 marks A sound understanding of how geological evidence indicates a global glaciation and can suggest a possible cause. Supported by limited evidence from the 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.* **1-2 marks** A partial understanding of glacial evidence. Aware of Snowball Earth theory**.** 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)	(i)	**Any two x (1) from:** • younger crust is shallow/ older crust deeper • rapid decay rate at first then slower • all oceans show a similar relationship within small deviation from best fit line • use of numbers	2			2		
		(ii)	**4714m** (range 4700 - 4720) (accept with/without working) (3) If incorrect – credit working Substitute d and t in original equation (1) Rearrange equation = $d = 2500 + 350\sqrt{t}$ (1) d = 2500 + 350(6.32) (1)		3		3	3	3
	(b)	(i)	**Any two x (1) from:** • all 3 oceans show a similar trend • younger crust is shallower in all 3 oceans/older crust deeper • few points deviate from line = strong correlation		2		2		2

Question			Marking details	Marks Available					
				AO1	AO2	AO3	Total	Maths	Prac
		(ii)	**Any three x (1) from:** • lithosphere of a particular age sinks to level to be supported by the mantle appropriate to its density • isostatic equilibrium • younger lithosphere warmer – nearer heat source (e.g. ridges, plumes) • younger lithosphere less dense/more buoyant – rises higher or vice versa • older lithosphere is colder – further from heat source • older lithosphere denser, thicker, sinks deeper		3		3		
	(c)		**Any one x (1) from:** • using magnetic anomalies patterns/magnetometer • field reversals locked into rock • palaeomagnetism in rock explained **And** Compared to known magnetic reversal time scale obtained from continental rock (R)	2			2		
			Question 13 total	**4**	**8**	**0**	**12**	**3**	**5**

Question			Marking details	Marks Available					
				AO1	AO2	AO3	Total	Maths	Prac
14	(a)	(i)	Moho correctly positioned at 7km. (1)	1			1		
		(ii)	**Any two x (1) from:** • age is young • seafloor spreading/crust moves away from axis • before sediment can settle	2			2		
		(iii)	Incompressibility and/or rigidity increase (1) Increase at a greater rate (1) Than increase in density (accept change in rock type) (1)		3		3		
		(iv)	**Any one x (1) from:** • ophiolites • ocean drilling • xenoliths	1			1		
	(b)	(i)	Gabbro (1) ~45% (range 41-50) (1)	2			2		
		(ii)	**Any three x (1) from:** • Moho may be the lower limit of seawater penetration • Moho may be the level above which mantle peridotite has altered to serpentinite • Moho may not reflect the crust-mantle boundary • Moho may not reflect a compositional change – gabbro to peridotite			3	3		
			Question 14 total	**6**	**3**	**3**	**12**	**0**	**0**

Question			Marking details	Marks available					
				AO1	AO2	AO3	Total	Maths	Prac
15			**Indicative content** Forces in orogenic belts mainly compressional - crustal shortening. Tectonic stresses produce folding (ductile) and/or faulting (brittle), related to depth (confining pressure and temperature) and rock competence. Relationship between principal stress orientation and type of deformation. Fold mountains and thrust belt (recumbent folds, shearing along low angle thrust faults. Nappe structures, accretionary prisms. Strike slip movement). Examples **5-6 marks** A thorough understanding of principal stress orientations and the type of deformation that results at convergent plate boundaries. A range of appropriate fold and fault structures identified (including nappes, accretionary prisms and strike slip faults). Possible reference to the stress strain curve, ductile and brittle behaviour, related to pressure, temperature and rock competence. *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	0	0

			3-4 marks A sound understanding of compressional forces and an appropriate range of structures linked to crustal shortening identified. Reference to both folds (including overturned/recumbent) AND faults (reverse/thrust). Links tectonic stress to convergent plate margins. *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 tectonic stresses resulting in crustal shortening to produce folds OR faults at convergent plate margins. *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**