GCE

Geography

H481/01: Physical systems

Advanced GCE

Mark Scheme for June 2019

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This mark scheme is published as an aid to teachers and students, to indicate the requirements of the examination. It shows the basis on which marks were awarded by examiners. It does not indicate the details of the discussions which took place at an examiners' meeting before marking commenced.

All examiners are instructed that alternative correct answers and unexpected approaches in candidates' scripts must be given marks that fairly reflect the relevant knowledge and skills demonstrated.

Mark schemes should be read in conjunction with the published question papers and the report on the examination.

Annotations

Annotation	Meaning
	Highlight
	Off page comment
^	Omission
?	Indicates a whole answer for which there is no credit
R	Rubric error (place at start of Question not being counted)
L1	Level 1
L2	Level 2
L3	Level 3
A1	A01 point made
A2	A02 point made
DEV	Development of a point
IRRL	Irrelevant; a significant amount of material that does not answer the question
SEEN	Point has been seen and noted
PLC	Place specific detail
	Highlighting an issue e.g. irrelevant paragraph. Use in conjunction with another stamp e.g IRRL
BP	Must be used on all blank pages where there is no candidate response
✓	Correct – for objective points based mark schemes
BOD	Benefit of the Doubt

Subject Specific Marking Instructions

INTRODUCTION

Your first task as an Examiner is to become thoroughly familiar with the material on which the examination depends. This material includes:

- the specification, especially the assessment objectives
- the question paper and its rubrics
- the mark scheme.

You should ensure that you have copies of these materials.

You should ensure also that you are familiar with the administrative procedures related to the marking process. These are set out in the OCR booklet **Instructions for Examiners**. If you are examining for the first time, please read carefully **Appendix 5 Introduction to Script Marking: Notes for New Examiners**.

Please ask for help or guidance whenever you need it. Your first point of contact is your Team Leader.

USING THE MARK SCHEME

Please study this Mark Scheme carefully. The Mark Scheme is an integral part of the process that begins with the setting of the question paper and ends with the awarding of grades. Question papers and Mark Schemes are developed in association with each other so that issues of differentiation and positive achievement can be addressed from the very start.

This Mark Scheme is a working document; it is not exhaustive; it does not provide 'correct' answers. The Mark Scheme can only provide 'best guesses' about how the question will work out, and it is subject to revision after we have looked at a wide range of scripts.

The Examiners' Standardisation Meeting will ensure that the Mark Scheme covers the range of candidates' responses to the questions, and that all Examiners understand and apply the Mark Scheme in the same way. The Mark Scheme will be discussed and amended at the meeting, and administrative procedures will be confirmed. Co-ordination scripts will be issued at the meeting to exemplify aspects of candidates' responses and achievements; the co-ordination scripts then become part of this Mark Scheme.

Before the Standardisation Meeting, you should read and mark in pencil a number of scripts, in order to gain an impression of the range of responses and achievement that may be expected.

In your marking, you will encounter valid responses which are not covered by the Mark Scheme: these responses must be credited. You will encounter answers which fall outside the 'target range' of Bands for the paper which you are marking. Please mark these answers according to the marking criteria. Please read carefully all the scripts in your allocation and make every effort to look positively for achievement throughout the ability range. Always be prepared to use the full range of marks.

LEVELS OF RESPONSE QUESTIONS:

The indicative content indicates the expected parameters for candidates' answers, but be prepared to recognise and credit unexpected approaches where they show relevance.

Using 'best-fit', decide first which set of level descriptors best describes the overall quality of the answer. Once the level is located, adjust the mark concentrating on features of the answer which make it stronger or weaker following the guidelines for refinement.

Highest mark: If clear evidence of all the qualities in the level descriptors is shown, the HIGHEST Mark should be awarded.

Lowest mark: If the answer shows the candidate to be borderline (i.e. they have achieved all the qualities of the levels below and show limited evidence of meeting the criteria of the level in question) the LOWEST mark should be awarded.

Middle mark: This mark should be used for candidates who are secure in the level. They are not 'borderline' but they have only achieved some of the qualities in the level descriptors.

Be prepared to use the full range of marks. Do not reserve (e.g.) highest level marks 'in case' something turns up of a quality you have not yet seen. If an answer gives clear evidence of the qualities described in the level descriptors, reward appropriately.

Quality of extended response will be assessed in questions marked with an (*). Quality of extended response is not attributed to any single assessment objective but instead is assessed against the entire response for the question.

	AO1	AO2	AO3	Quality of extended response
Comprehensive	A wide range of detailed and accurate knowledge that demonstrates fully developed understanding that shows full relevance to the demands of the question. Precision in the use of question terminology.	Knowledge and understanding shown is consistently applied to the context of the question, in order to form a: Clear, developed and convincing analysis that is fully accurate. Clear, developed and convincing interpretation that is fully accurate. Detailed and substantiated evaluation that offers secure judgements leading to rational conclusions that are evidence based.	Quantitative, qualitative and/or fieldwork skills are used in a consistently appropriate and effective way and with a high degree of competence and precision.	There is a well-developed line of reasoning which is clear and logically structured. The information presented is relevant and substantiated.
Thorough	A range of detailed and accurate knowledge that demonstrates well developed understanding that is relevant to the demands of the question. Generally precise in the use of question terminology.	Knowledge and understanding shown is mainly applied to the context of the question, in order to form a: Clear and developed analysis that shows accuracy. Clear and developed interpretation that shows accuracy. Detailed evaluation that offers generally secure judgements, with some link between rational conclusions and evidence.	Quantitative, qualitative and/or fieldwork skills are used in a suitable way and with a good level of competence and precision.	There is a line of reasoning presented with some structure. The information presented is in the most-part relevant and supported by some evidence.

	AO1	AO2	AO3	Quality of extended response
Reasonable	Some sound knowledge that demonstrates partially developed understanding that is relevant to the demands to the question. Awareness of the meaning of the terms in the question.	Knowledge and understanding shown is partially applied to the context of the question, in order to form a: Sound analysis that shows some accuracy. Sound interpretation that shows some accuracy. Sound evaluation that offers generalised judgments and conclusions, with limited use of evidence.	Quantitative, qualitative and/or fieldwork skills are used in a mostly suitable way with a sound level of competence but may lack precision.	There information has some relevance and is presented with limited structure. The information is supported by limited evidence.
Basic	Limited knowledge that is relevant to the topic or question with little or no development. Confusion and inability to deconstruct terminology as used in the question.	Knowledge and understanding shows limited application to the context of the question in order to form a: Simple analysis that shows limited accuracy. Simple interpretation that shows limited accuracy. Un-supported evaluation that offers simple conclusions.	Quantitative, qualitative and/or fieldwork skills are used inappropriately with limited competence and precision.	The information is basic and communicated in an unstructured way. The information is supported by limited evidence and the relationship to the evidence may not be clear.

Question			Answer	Mark	Guidance
1	(a)		**Explain the role of flows of energy in the formation of a tombolo.** **Level 3 (6-8 marks)** Demonstrate **thorough** knowledge and understanding of the role of flows of energy in the formation of tombolos (AO1). This will be shown by including **well-developed** ideas with a **clear** appreciation of the role of flows of energy in the formation of tombolos. **Level 2 (3-5 marks)** Demonstrate **reasonable** knowledge and understanding of the role of flows of energy in the formation of tombolos (AO1). This will be shown by including **developed** ideas with **some** appreciation of the role of flows of energy in the formation of tombolos. **Level 1 (1-2 marks)** Demonstrate **basic** knowledge and understanding of the role of flows of energy in the formation of tombolos (AO1). This will be shown by including **simple** ideas with **no** or **limited** appreciation of the role of flows of energy in the formation of tombolos. **0 marks** No response or no response worthy of credit.	**8** **AO1 x8**	**Indicative content:** **AO1 – 8 marks** Knowledge and understanding of the role of flows of energy in the formation of tombolos could potentially include: • There is controversy over the exact formation – some formed by drift aligned features, others through sea level rise • Prevailing winds determine direction and power of waves that would create conditions suitable for deposition • Wave refraction around an off-shore island causing a wave-energy shadow where increased deposition occurs on the landward side • Longshore drift would be caused by waves causing movement of sediment through energy absorbed by winds • A spit starts to form growing seawards until they reach and adjoin an offshore island • The resulting beaches may be covered during high tide e.g. Lindisfarne, Northumberland or St Agnes, Scilly Isles • Chesil Beach, Dorset is a tombolo formed in a more complex manner. Most likely the beach developed as a barrier island and moved onshore during the Flandrian Transgression as sea levels rose, enabling waves to move material onshore
1	(b)	(i)	**Find the mode(s) of the data set shown in Table 1.**	**2** **AO3 x2**	**AO3 – 2 marks** 2 x 1 mark (✓) 1 mark for each correct answer

			Order the numbers from highest to lowest: 130, 100, 93, 69, 50, 50, 43, 20, 20, 0 Modal values = most frequently occurring = 20 (✓), 50 (✓) 1 mark for both correct values		20, 50 correct modal values 2 x 1 mark for each correct answer **Benefit Of the Doubt (BOD) 2 marks** **Interpreted as two data sets:** • Summer 50 [*they might not always write Winter as there is mode for Winter but will still get 2 marks*] • Summer 50, Winter no mode • Input 50 [*they might not always write Output as there is no mode for Output*] • Input 50, Output no mode **Interpreted as four data sets:** • Input 50, Output no mode, Summer 50, Winter no mode
1	**(b)**	**(ii)**	**Calculate the sediment budget for each season shown in <u>Table 1</u>.** Season Input - Output = Summer 143 - 113 = 30m³ ✓ Winter 120 - 199 = -79m³ ✓	**2** **AO3 x2**	**AO3 – 2 marks** 2 x 1 mark (✓) Units (m³) are not required in order to get the mark. Accept comments such as 79m³ outputted to imply a negative.
1	**(b)**	**(iii)**	**State whether each season was in a surplus, deficit or equilibrium state.** Summer = surplus Winter = deficit	**2** **AO3 x2**	**AO3 – 2 marks** 2 x 1 mark (✓) 1 mark for each correct answer.

1	(c)		**With reference to <u>Fig. 1,</u> explain the role of <u>one geomorphic process</u> in the formation of landform A.** • Waves eroded resistant rock through pounding, hydraulic action and abrasion during inter-glacial periods • Mechanical weathering e.g. freeze-thaw evidenced by block disintegration. Rainwater accessing cracks in the rock face and freezing overnight. Ice takes up 9% more volume than water putting increased pressure on cliff face and continual repetition forces joints and bedding planes to expand • Biological weathering with growth of vegetation on cliff face through chelation and the release of humic acid from decomposing vegetation. Likely to be a very slow process due to Scotland's low temperatures • Mass movement as cliff collapses and retreats landward – likely to be in the past as vegetated slopes indicate stability	**3** **AO2 x3**	**AO2 – 3 marks** 3 x 1 (✓) for analysing Fig. 1 to explain the role of any one geomorphic process (such as weathering, erosion, mass movement) in the formation of landform A (abandoned cliff). Candidates may explain the initial formation of the cliff; this is acceptable. Geomorphic processes could include types of erosion, weathering and mass movement amongst others. Water may enter cracks in the rock (✓). When this water freezes, there is subsequent expansion (✓). This increases pressure on the rock and it breaks apart (✓).
1	(d)*		**'Geology is the most significant influence on coastal landscapes'. To what extent do you agree with this statement?** **AO1** **Level 3 (6-8 marks)** Demonstrates **comprehensive** knowledge and understanding of the influence geology has on coastal landscapes. The answer should include **accurate place-specific** detail. **Level 2 (3-5 marks)**	**16** **AO1 x8** **AO2 x8**	**Indicative content** **AO1 – 8 marks** Knowledge and understanding of the influence geology has on coastal landscapes could potentially include: • Lithology determining resistance of rock and type e.g. clays, basalt, granite, chalk, carboniferous limestone • Comments about the vulnerability of rock types to particular erosion or weathering would be relevant e.g. granite to hydrolysis, or limestone to carbonation • Structure determining porosity and permeability • Structure and tectonic movement determining

			Demonstrates **thorough** knowledge and understanding of the influence geology has on coastal landscapes. The answer should include **place-specific** detail which is **partially accurate**. **Level 1 (1-2 marks)** Demonstrates **basic** knowledge and understanding of the influence geology has on coastal landscapes. There is an attempt to include **place-specific** detail but it is **inaccurate**. **0 marks** No response or no response worthy of credit. **AO2** **Level 3 (6-8 marks)** Demonstrates **comprehensive** application of knowledge and understanding to provide clear and developed analysis that shows accuracy to provide a detailed evaluation that offers generally secure judgements, with some link between rational conclusions and evidence, of the relative significance of geology shaping coastal landscapes. **Level 2 (3-5 marks)** Demonstrates **thorough** application of knowledge and understanding to provide sound analysis that shows some accuracy to provide a sound evaluation that offers generalised judgements and conclusions, with limited use of evidence, of the relative significance of geology shaping coastal landscapes. **Level 1 (1-2 marks)** Demonstrates **basic** application of knowledge and understanding to provide simple analysis that shows limited accuracy to provide an un-supported evaluation that offers simple conclusions of the relative		dip of bedding planes • Erosional landforms with steep profiles found with resistant rocks e.g. chalk or limestone headlands in discordant coastlines • Shore platforms usually found with seaward dip of 1-3° • Master joints required for geos and blowholes • Examples could be applied from any coastline and at a variety of scales e.g. macro could be a stretch of a particular coastline or micro could be a single landform within a coastline **AO2 – 8 marks** Apply knowledge and understanding to analyse and evaluate the relative significance of geology shaping coastal landscapes could potentially include: • In the Nile delta geology plays a minimal part in the provision of fine sand to the delta system. More influential is the sheltered, low energy environment allowing the build up of sediment to form an alluvial delta • From Saltburn to Flamborough Head, UK geology plays a significant role in formation of bays and headlands, although these would not form without a discordant coastline. Master joints open up weaknesses for formation of geos, and blowholes at Selwick's Bay as well as lines of weaknesses to be exploited overtime to create stacks • Geology contributes to formation of headlands e.g. the resistant chalk at Flamborough Head creating near vertical cliffs which is more significant than the 1600km fetch from the N which creates differential erosion exposing the headlands further

			significance of geology shaping coastal landscapes. **0 marks** No response or no response worthy of credit. **Quality of extended response** **Level 3** There is a well-developed line of reasoning which is clear and logically structured. The information presented is relevant and substantiated. **Level 2** There is a line of reasoning presented with some structure. The information presented is in the most-part relevant and supported by some evidence. **Level 1** The information is basic and communicated in an unstructured way. The information is supported by limited evidence and the relationship to the evidence may not be clear.		• Role of sea level rise and fall in formation of emergent and submergent landforms can be judged against the geological influences. The geology at Knightsbridge estuary, Devon has very little influence in the formation of a ria in comparison to sea level rise, which floods the valley deepening the channel despite increased fluvial deposition during the Flandrian Transgression, which shape the ria more significantly that the surrounding geology • Candidates may use case studies from 1.4 to evidence their claims and judge the significance of geology alongside the influence of deliberate human interference or economic development

Question			Answer	Mark	Guidance
2	(a)		**Explain the role of flows of energy in the formation of an erratic.** **Level 3 (6-8 marks)** Demonstrate **thorough** knowledge and understanding of the role of flows of energy in the formation of an erratic (AO1). This will be shown by including **well-developed** ideas with a **clear** appreciation of the role of flows of energy in the formation of an erratic **Level 2 (3-5 marks)** Demonstrate **reasonable** knowledge and understanding of the role of flows of energy in the formation of an erratic (AO1). This will be shown by including **developed** ideas with **some** appreciation of the role of flows of energy in the formation of an erratic **Level 1 (1-2 marks)** Demonstrate **basic** knowledge and understanding of the role of flows of energy in the formation of an erratic (AO1). This will be shown by including **simple** ideas with **no** or **limited** appreciation of the role of flows of energy in the formation of an erratic **0 marks** No response or no response worthy of credit.	8 AO1 x8	**Indicative content:** **AO1 – 8 marks** Knowledge and understanding of the role of flows of energy in the formation of an erratic could potentially include: • An erratic is an individual piece of rock. It can be as small as a pebble, up to the size of a large boulder. They are made up of a different geology to the surrounding environment. • Kinetic energy from the moving glacier transporting the rock from its original location to a new geological surrounding • As temperatures rose the sun's thermal energy melts the glacier in periglacial periods. Over time with prolonged thermal energy through the sun the erratic is exposed • Further kinetic energy may contribute to the final resting place if the erratic is deposited on a slope and moved as part of an avalanche or mass movement • Meltwater streams may also move the erratic further down the valley through kinetic energy
2	(b)	(i)	**Find the mode(s) of the data set shown in <u>Table 2</u>.** Order the numbers from highest to lowest:	2 AO3 x2	**AO3 – 2 marks** 2 x 1 mark (✓) 10, 0 correct modal values 2 x 1 mark for each correct answer

			170, 120, 50, 40, 10, 10, 3, 1, 0, 0 Modal value = most frequently occurring = 10 (✓), 0 (✓)		**Benefit Of the Doubt (BOD) 2 marks (Alternative interpretation of 'Data Set')** **Interpreted as two data sets:** • Input 0 [*they might not write always write Output as there is no mode for Output but will still get 2 marks*] • Input 0, Output no mode **Interpreted as four data sets:** • Summer 0, Winter 10, Input 0, Output no mode
2	**(b)**	**(ii)**	**Calculate the mass balance for each season shown in <u>Table 2.</u>** Season Input - Output = Summer 1 - 170 = -169cm³ ✓ Winter 220 - 12 = 208cm³ ✓	**2** **AO3 x2**	**AO3 – 2 marks** 2 x 1 mark (✓) 1 mark for each correct answer. Units (cm³) are not required in order to get the mark. Accept comments such as 169cm³ outputted to imply a negative
2	**(b)**	**(iii)**	**State whether each season was in a surplus, deficit or equilibrium state.** Summer = deficit Winter = surplus	**2** **AO3 x2**	**AO3 – 2 marks** 2 x 1 mark (✓) 1 mark for each correct answer.
2	**(c)**		**With reference to <u>Fig. 2</u>, explain the role of <u>one</u> geomorphic process in the formation of landform B.** • Closed-system pingos form under lake beds. Water seeps into talik where it is insulated in the soil. As temperatures drop, the permafrost expands against the saturated talik which is under increasing hydrostatic pressure. When the talik freezes, overlying sediments are forced up into a	**3** **AO2 x3**	**AO2 – 3 marks** 3 x 1 (✓) for analysing Fig. 2 to explain the role of any one geomorphic process in the formation of landform B (pingo).

			dome. • OR open system pingo formed by water collecting under artesian pressure, freezing, expanding and forcing the surface to dome upwards. • OR could refer to surface of pingo collapsing due to thawing as climate warms, leading to melting of the ice core and surface subsidence.		
2	**(d)***		**'Geology is the most significant influence on glaciated landscapes'. To what extent do you agree with this statement?** **AO1** **Level 3 (6-8 marks)** Demonstrates **comprehensive** knowledge and understanding of the influence of geology on glaciated landscapes. The answer should include **accurate place-specific** detail. **Level 2 (3-5 marks)** Demonstrates **thorough** knowledge and understanding of the influence of geology on glaciated landscapes. The answer should include **place-specific** detail which is **partially accurate**. **Level 1 (1-2 marks)** Demonstrates **basic** knowledge and understanding of the influence of geology on glaciated landscapes. There is an attempt to include **place-specific** detail but it is **inaccurate**. **0 marks** No response or no response worthy of credit.	**16** **AO1 x8** **AO2 x8**	**Indicative content** **AO1 – 8 marks** Knowledge and understanding of the influence geology has on glaciated landscapes could potentially include: • Lithology determining resistance of rock and type e.g. clays, basalt, granite, chalk, carboniferous limestone • Comments about the vulnerability of rock types to particular erosion or weathering would be relevant e.g. granite to frost shattering, or limestone to carbonation • Structure determining porosity and permeability which influence weathering processes • Structure and tectonic movement determining dip of bedding planes • Erosional landforms with steep profiles found with resistant rocks e.g. chalk or limestone steep valley sides • Resistant rock required for formation of striations and roche moutonnées • Change in geology required for erratic • Use of case studies to illustrate influence of geology against other factors shaping the glaciated landscape e.g. climate, relief, aspect etc • Examples could be applied from any glaciated landscape and at a variety of scales e.g. macro

			AO2 **Level 3 (6-8 marks)** Demonstrates **comprehensive** application of knowledge and understanding to provide clear and developed analysis that shows accuracy to provide a detailed evaluation that offers generally secure judgements, with some link between rational conclusions and evidence, of the relative significance of the influence of geology in the formation of glaciated landforms. **Level 2 (3-5 marks)** Demonstrates **thorough** application of knowledge and understanding to provide sound analysis that shows some accuracy to provide a sound evaluation that offers generalised judgements and conclusions, with limited use of evidence, of the relative significance of the influence of geology in the formation of glaciated landforms. **Level 1 (1-2 marks)** Demonstrates **basic** application of knowledge and understanding to provide simple analysis that shows limited accuracy to provide an un-supported evaluation that offers simple conclusions of the relative significance of the influence of geology in the formation of glaciated landforms. **0 marks** No response or no response worthy of credit. **Quality of extended response** **Level 3** There is a well-developed line of reasoning which is clear and logically structured. The information		could be a region of a country or micro could be a single landform within a glaciated system **AO2 – 8 marks** Apply knowledge and understanding to analyse and evaluate the relative significance of geology shaping glaciated landscapes could potentially include: • Landscapes associated with the action of valley glaciers e.g. the Borrowdale volcanic group forming the Helvellyn range in the Lake District and Red Tarn and Nethermost Cove due to the resistant rock type that enables erosional features. • The irregular shape of Ullswater (glacial trough) due to the bands of resistant igneous rock illustrates the significance influence of geology as this determines the rates of differential erosion giving the trough its unusual shape • Norfolk Island formed from Borrowdale volcanic rock (roche moutonnée). Despite strong glacial action, the geology is significant to the formation of the roche moutonnée. • Landscape associated with the action of ice sheets e.g. the weak shale rocks exposed to erosion in the Arrowhead region of northeast Minnesota in comparison to the more resistant igneous rocks surrounding them, or the resistant rocks enabling striations to form on outcrops of gneiss and greenstone. • The landforms of glacio-fluvial deposition could be examined against the significance of geology e.g. kame terraces more sorted and graded indicating geology less influential against transportation and depositional influences, or lack of influence in formation of pingos as frozen

			presented is relevant and substantiated. **Level 2** There is a line of reasoning presented with some structure. The information presented is in the most-part relevant and supported by some evidence. **Level 1** The information is basic and communicated in an unstructured way. The information is supported by limited evidence and the relationship to the evidence may not be clear.		ground more significant than rock type • Candidates may use case studies to evidence their claims and judge the significance of geology alongside the influence of climate change (2.3) or human activity (2.4).

3	(a)		**Explain the role of flows of energy in the formation of a barchan.** **Level 3 (6-8 marks)** Demonstrate **thorough** knowledge and understanding of the role of flows of energy in the formation of a barchan (AO1). This will be shown by including **well-developed** ideas with a **clear** appreciation of the role of flows of energy in the formation of a barchan **Level 2 (3-5 marks)** Demonstrate **reasonable** knowledge and understanding of the role of flows of energy in the formation of a barchan (AO1). This will be shown by including **developed** ideas with **some** appreciation of the role of flows of energy in the formation of a barchan **Level 1 (1-2 marks)** Demonstrate **basic** knowledge and understanding of the role of flows of energy in the formation of a barchan (AO1). This will be shown by including **simple** ideas with **no** or **limited** appreciation of the role of flows of energy in the formation of a barchan **0 marks** No response or no response worthy of credit.	**8** **AO1 x8**	**Indicative content:** **AO1 – 8 marks** Knowledge and understanding of the role of flows of energy in the formation of a barchan could potentially include: • A barchan is a crescent shaped sand dune (in planform) with two horns facing downwind • Winds blowing from one predominant direction causing transfer of kinetic energy as material moved by creep, saltation and suspension • Energy flows fairly consistent with strong and persistent winds • Windward slope formed as friction causes a slowing of the wind and subsequent deposition creating a gentle slope around 12° • Kinetic energy transfer as small avalanches occur down very steep slip face as angle becomes unstable • Migration of entire landform up to 30m/year • Significant wind direction can destroy crescent form as kinetic energy transferred to erosion
3	(b)	(i)	**Find the mode(s) of the data set shown in <u>Table 3</u>.** Order the numbers from highest to lowest:	**2** **AO3 x2**	**AO3 – 2 marks** 2 x 1 mark (✓) 4, 0 correct modal values 2 x 1 mark for each correct answer

			2000, 194, 20, 8, 4, 4, 2, 1, 0, 0 Modal value = most commonly occurring = 4 (✓), 0 (✓)		**Benefit Of the Doubt (BOD) 2 marks (Alternative interpretation of 'Data Set')** • Input 0 [*they might not always write Output as there is no mode for Output but will still get 2 marks*] • Input 0, Output no mode • Summer 0, Winter 4, Input 0, Output no mode
3	**(b)**	**(ii)**	**Calculate the water balance for each season shown in <u>Table 3</u>.** Season Input - Output = Summer 2 - 2020 = -2018mm³ ✓ Winter 199 - 12 = 187mm³ ✓	**2** **AO3 x2**	**AO3 – 2 marks** 2 x 1 mark (✓) 1 mark for each correct calculation. Units (mm³) are not required in order to get the mark. Accept comments such as 2018mm³ outputted to imply a negative
3	**(b)**	**(iii)**	**State whether each season was in a surplus, deficit or equilibrium state.** Summer = deficit Winter = surplus	**2** **AO3 x2**	**AO3 – 2 marks** 2 x 1 mark (✓) 1 mark for each correct answer.

3	**(c)**		**With reference to <u>Fig. 3</u>, explain the role of <u>one</u> geomorphic process in the formation of landform C.** • During cooler climatic periods, the ground was frozen and a shallow surface layer of ice lay on current dryland areas • Precipitation entered cracks and joints in exposed rocks, which repeatedly froze and thawed. The constant pressure of 9% volume increase when freezing and the release of pressure when thawing caused block disintegration. Angular boulders were deposited contributing to the many boulders now present in the frost shattered debris • At this time, smaller sediment could have been moved by frost heave and gelifluction causing a build-up of material between larger boulders • Talus slopes may have been created at this time following repeated frost weathering forming a barrier to the edge of the frost shattered debris	**3** **AO2 x3**	**AO2 – 3 marks** 3 x 1 (✓) for analysing Fig. 3 to explain the role of any one geomorphic process in the formation of landform C (frost shattered debris)
3	**(d)***		**'Geology is the most significant influence on dryland landscapes'. To what extent do you agree with this statement?** **AO1** **Level 3 (6-8 marks)** Demonstrates **comprehensive** knowledge and understanding of the influence geology has on dryland landscapes. The answer should include **accurate place-specific** detail. **Level 2 (3-5 marks)** Demonstrates **thorough** knowledge and understanding of the influence geology has on dryland landscapes.	**16** **AO1 x8** **AO2 x8**	**Indicative content** **AO1 – 8 marks** Knowledge and understanding of the influence geology has on dryland landscapes could potentially include: • Lithology determining resistance of rock and type e.g. clays, basalt, granite, chalk, carboniferous limestone • Comments about the vulnerability of rock types to particular erosion or weathering would be relevant e.g. granite to exfoliation or jointed rocks to freeze-thaw weathering processes • Structure determining porosity and permeability e.g. rocks with high porosity and permeability can create drought at the surface e.g. pumice fields in Iceland or Causses in France

			The answer should include **place-specific** detail which is **partially accurate**. **Level 1 (1-2 marks)** Demonstrates **basic** knowledge and understanding of the influence geology has on dryland landscapes. There is an attempt to include **place-specific** detail but it is **inaccurate**. **0 marks** No response or no response worthy of credit. **AO2** **Level 3 (6-8 marks)** Demonstrates **comprehensive** application of knowledge and understanding to provide clear and developed analysis that shows accuracy to provide a detailed evaluation that offers generally secure judgements, with some link between rational conclusions and evidence, of the relative significance of the influence geology has on dryland landscapes. **Level 2 (3-5 marks)** Demonstrates **thorough** application of knowledge and understanding to provide sound analysis that shows some accuracy to provide a sound evaluation that offers generalised judgements and conclusions, with limited use of evidence, of the relative significance of the influence geology has on dryland landscapes. **Level 1 (1-2 marks)**		• Structure and tectonic movement determining dip of bedding planes • Significance of underlying geology e.g. water deficit can be more severe because of impermeable bedrock causing large canyons, ravines and gullies e.g. Badlands, South Dakota • Role of impermeable rock in wadi formation • Parallel retreat enabled due to dip and presence of bedding planes • Use of case studies to illustrate influence of geology against other factors shaping the coastline e.g. climate, wind, sediment availability (which could be linked to geology), latitude, relief, human activity etc • Examples could be applied from any dryland and at a variety of scales e.g. macro could be a stretch of a particular desert or micro could be a single landform within a dryland environment **AO2 – 8 marks** Apply knowledge and understanding to analyse and evaluate the relative significance of geology shaping dryland landscapes could potentially include: • Mid-latitude desert e.g. Colorado Plateau has many different layers (limestone, sandstone, siltstone and shale) of bedrock, creating a stepped canyon profile (Gran Canyon). Differential geology significant in formation otherwise canyon smoother sides with more uniform profile. • Colorado Plateau has also been relatively unaffected by rock deformation, creating similar landforms e.g. slope profiles in Monument Valley • Low-latitude desert e.g. Namib, differential

			Demonstrates **basic** application of knowledge and understanding to provide simple analysis that shows limited accuracy to provide an un-supported evaluation that offers simple conclusions of the relative significance of the influence geology has on dryland landscapes. **0 marks** No response or no response worthy of credit. **Quality of extended response** **Level 3** There is a well-developed line of reasoning which is clear and logically structured. The information presented is relevant and substantiated. **Level 2** There is a line of reasoning presented with some structure. The information presented is in the most-part relevant and supported by some evidence. **Level 1** The information is basic and communicated in an unstructured way. The information is supported by limited evidence and the relationship to the evidence may not be clear.		weathering of granite causing creation of inselbergs (e.g. Spitzkoppe) and pediments. The frequency of jointing in the rock is thought to have caused the formation of the two different landforms. Closely jointed granite weathering by chemical processes to form pediments, and widely spaced jointed granite weathered more slowly forming inselbergs. Role of geology in determining the spacing of joints more significant in landform formation than role of chemical weathering • Role of precipitation, temperature and cooler climates to form boulder fields (e.g. Semien Highlands, Ethiopia) along with the jointing required for precipitation to enter the rock. Without this boulder fields would not be created, so more significance than role of freeze-thaw weathering for example. • Use of case studies to illustrate influence of geology against other factors shaping the coastline e.g. climate, wind, sediment availability (which could be linked to geology), latitude, relief, human activity etc • Candidates may use case studies to evidence their claims and judge the significance of geology alongside the influence of climate change (3.3) or human activity (3.4).

Question			Answer	Mark	Guidance
4	(a)	(i)	**With reference to <u>Fig. 4</u>, suggest how variations in temperature influence the size of <u>one</u> store in the carbon cycle.**	**4** **AO2 x 4**	**AO2 – 4 marks** 1 x 1 mark (✓) for interpretation of the climate graph in Fig. 7 to link to an appropriate store. 3 x 1 (DEV) to explain the influence of temperature on the size of this store. Appropriate stores (✓): Permafrost Vegetation Biomass Soil Atmosphere Ice No credit for mirrored answers.
4	(a)	(ii)	**Explain <u>three</u> limitations of such climate graphs in representing the climatic conditions of a location.** Monthly data hides variations within the month (✓) The graph does not take into account spatial variations within Yakutsk (✓) Climate data is based on 30-year averages so hides annual variations over time (✓) and masks current climate change (✓) Temperature data doesn't reflect diurnal variations (✓) Type of precipitation not shown (✓) Climate also includes other variables e.g. wind speed and wind direction which are not shown (✓)	**3** **AO3 x3**	**AO3 – 3 marks** 3 x 1 (✓) for three limitations of climate graphs. No credit for reference to difficulty reading the axes/no exact figures.
4	(b)		**Examine the significance of short term changes to**	**10**	**Indicative content**

			the flows and stores in the water cycle. **Level 3 (7-10 marks)** Demonstrates **comprehensive** knowledge and understanding of short term changes to flows and stores in the water cycle (AO1). Demonstrates **thorough** application of knowledge and understanding to provide a detailed account of the significance of short term changes to flows and stores in the water cycle (AO2). This will be shown by including **well-developed** ideas of the significance of short term changes to flows and stores in the water cycle. **Level 2 (4-6 marks)** Demonstrates **thorough** knowledge and understanding of short term changes to flows and stores in the water cycle (AO1). Demonstrates **reasonable** application of knowledge and understanding to provide a detailed account of the significance of short term changes to flows and stores in the water cycle (AO2). This will be shown by including **developed** ideas of the significance of short term changes to flows and stores in the water cycle. **Level 1 (1–3 marks)** Demonstrates **basic** knowledge and understanding of short term changes to flows and stores in the water cycle (AO1). Demonstrates **basic** application of knowledge and understanding to provide an account of the significance of short term changes to flows and stores in the water cycle (AO2).	**AO1 6** **AO2 4**	**AO1 – 6 marks** Knowledge and understanding of short term changes to flows and stores in the water cycle could potentially include: • Diurnal changes – lower night time temperatures reduce flows of evaporation and transpiration, however they can create conditions perfect for condensation leading to the formation of fog, mist, dew and frost. Convectional precipitation does not occur at night. • Seasonal changes – these will vary according to latitude. Comments concerning contrasts in summer and winter, or dry and rainy seasons would be appropriate. In the UK evapotranspiration peaks in summer months, and is lowest in winter, stores in the biomass will be significantly larger in the summer. Frozen surface storage will be higher in winter and in many places, non-existent in summer. However in tropical climates, surface storage will be much higher at the beginning of the rainy season, whereas as the season wears on surface storage often reduces allowing for more soil moisture storage and the replenishment of groundwater stores. **AO2 – 4 marks** Apply knowledge and understanding to provide a detailed account of the significance of short term changes to flows and stores in the water cycle could potentially include: • In the UK the impact of diurnal changes is less but still significant. In coastal regions diurnal changes influence land sea breezes impacting the stores of atmospheric water as fog and dew are formed by early morning. • In the tundra diurnal changes have a minimal impact as for several months of the year the sun has either set or risen. The impact of daily

			This will be shown by including **some** ideas about the significance of short term changes to flows and stores in the water cycle. **0 marks** No response or no response worthy of credit.		change is spread over several weeks so is more appropriate as a seasonal change. • Seasonal change in the tundra has massive impact on stores as permafrost melts leading to surface lakes and ponds with higher rates of evaporation in summer and more movement into the thawed soil allowing throughflow to occur. • The scale of change on the store or flow could be used as a measure of severity e.g. increase in evapotranspiration rates in summer linked to increased foliage compared to the reduction in winter severely impacting rates of stem flow, interception by vegetation and thus rates of infiltration and throughflow Short term changes that discuss activities such as deforestation and urbanisation are not credit-worthy.
4	**(c)***		**'Reducing emissions is the most effective global management strategy to protect the carbon cycle as a regulator of the Earth's climate'. How far do you agree with this statement?** **AO1** **Level 3 (6–8 marks)** Demonstrates **comprehensive** knowledge and understanding of the impact of global management strategies on protecting the carbon cycle. The answer should include **accurate place-specific detail**. **Level 2 (3–5 marks)** Demonstrates **thorough** knowledge and understanding of the impact of global management strategies on protecting the carbon cycle. The answer should include **some place-specific detail which is partially accurate**.	**16** **AO1 8** **AO2 8**	**Indicative content** **AO1 – 8 marks** Knowledge and understanding of global management strategies to protect the carbon cycle could potentially include: • Reducing emissions through international agreements e.g. Kyoto Agreement, Paris Agreement 2015, cap and trade initiatives and carbon offsets. • Afforestation – planting secondary forests will increase carbon store in biomass, reduce CO2 sink levels in the atmosphere. • Wetland restoration – includes freshwater and salt marshes, peatlands, floodplains and mangroves and contain 35% of terrestrial carbon pool • Improving agricultural practices – A number of different techniques from zero tillage which conserves the carbon in the soil and reduces wind and water erosion, to crop residue being left on fields which provides cover from erosion

			Level 1 (1–2 marks) Demonstrates **basic** knowledge and understanding of the impact of global management strategies on protecting the carbon cycle. There is an attempt to include place-specific detail but it is inaccurate. **0 marks** No response or no response worthy of credit. **AO2** **Level 3 (6-8 marks)** Application of knowledge and understanding is comprehensive. Analysis is clear, developed and convincing. Evaluation of the extent to which the impact of reducing emissions will successfully protect the global carbon cycle is detailed and substantiated. Judgements are secure and evidence based leading to rational conclusions. **Level 2 (3-5 marks)** Application of knowledge and understanding is reasonable. Analysis is sound with some development that is mostly relevant. Evaluation of the extent to which the impact of reducing emissions will successfully protect the global carbon cycle is sound but partial. Judgements are generalised with some use of evidence leading to appropriate conclusions. **Level 1 (1-2 marks)** Application of knowledge and understanding is basic. Analysis is simple with little or no development. Evaluation of the extent to which the impact of reducing emissions will successfully protect the global carbon cycle is weak or absent. Judgements, if present, are unsupported leading to simple conclusions.		and protects moisture content enabling decomposition. Using new varieties of rice reduces need for flooded rice fields which reduces the methane emissions. **AO2 – 8 marks** Apply knowledge and understanding to analyse and evaluate whether reducing emissions is the most effective global management strategy to protect the carbon cycle as a regulator of the Earth's climate could potentially include: • Afforestation o Tropical forests are those most at risk from deforestation (17% of the Amazon rainforest has been lost in the last 50 years). Yet of global afforestation, 75% is in temperate forests. Indicating that success in tropical areas is limited. Most of this is due to private enterprise which could limit success as more likely to be used for industry o UN REDD scheme in China successful in restoring biomass of non-native, fast-growing species of poplar and birch, but secondary forest is not as efficient as primary forest. A number of schemes in the Amazon already established. Countries with significant deforestation could see a large improvement here, but often through small scale projects, potentially limiting success o Globally UN REDD on Bali Roadmap in 2007 gaining international recognition and schemes occurring in range of different countries indicating wide acceptance and helping success • Wetland restoration o Only occupy 6-9% earth's surface, so even if wholly restored, impact on carbon cycle

			0 marks No response or no response worthy of credit. **Quality of extended response** **Level 3** There is a well-developed line of reasoning which is clear and logically structured. The information presented is relevant and substantiated. **Level 2** There is a line of reasoning presented with some structure. The information presented is in the most-part relevant and supported by some evidence. **Level 1** The information is basic and communicated in an unstructured way. The information is supported by limited evidence and the relationship to the evidence may not be clear.		will be limited. o Canada's prairie's lost 70% of wetlands, but are being restored at 3.25 tonnes/C/ha/year. 112,000 ha targeted for restoration sequestering 364,000 tonnes C/year. A slow rate of success but a significant sink is being protected o The UK is running a number of small – scale schemes from restoring wetlands from farmlands, raising the water table through controlled flooding, all assisting the government target of 500 ha of wetlands restored by 2020. A number of small scale projects provides a range of different wetland areas increasing biodiversity, however successful the small scale nature limits global success • Improving agricultural practices o Methods are small scale but protect carbon in soils which reduces GHG emissions and protects the atmospheric store • Reducing emissions o Through international agreements have had very limited success as some large contributors e.g. USA have not ratified treaties. Targets tend to be voluntary and not legally binding limiting success of targets and impact on atmospheric store of carbon o Cap and trade has been successful across the world at a number of scales, nationally across the European Union, within cities e.g. California, USA and Ontario, Canada. Ontario sold all permits within their business community, raising over $504 million for community projects e.g. schools being more energy efficient. Such schemes reduce emissions and protect the atmospheric carbon store. In California

					emissions have dropped annually since the introduction of cap and trade.

Assessment Objectives (AO) grid

Candidates answer **either** question 1 **or** question 2 **or** question 3 **and** question 4. This has been considered in the totals indicated below.

Question	AO1	AO2	AO3	Marks
…Either…				
1a	8			**8**
1bi			2	**2**
1bii			2	**2**
1biii			2	**2**
1c		3		**3**
1d	8	8		**16**
…Or…				
2a	8			**8**
2bi			2	**2**
2bii			2	**2**
2biii			2	**2**
2c		3		**3**
2d	8	8		**16**
…Or…				
3a	8			**8**
3bi			2	**2**
3bii			2	**2**
3biii			2	**2**
3c		3		**3**
3d	8	8		**16**
…And…				
4ai		4		**4**
4aii			3	**3**
4b	6	4		**10**
4c	8	8		**16**
Totals	**30**	**27**	**9**	**66**

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