OCR
Oxford Cambridge and RSA

GCE

Geography

Unit **H481/01:** Physical systems

Advanced GCE

Mark Scheme for June 2018

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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
BP	Must be used on all blank pages where there is no candidate response
✓	Correct
DEV	Development of a point
A1	AO1 point made
A2	AO2 point made
L1	Level 1
L2	Level 2
L3	Level 3
PLC	Place specific detail
SEEN	Point has been seen and noted
IRRL	Irrelevant; a significant amount of material that does not answer the question
	Highlighting an issue e.g. irrelevant paragraph. Use in conjunction with another stamp e.g IRRL
?	Point made is unclear
R	Rubric error (place at start of Question not being counted)

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 of 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 judgements 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.	The 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)	A1 L1 L2 L3	**Explain how a sediment cell can be viewed as a system.** **Level 3 (6-8 marks)** Demonstrate **thorough** knowledge and understanding of how a sediment cell be viewed as a system (AO1). This will be shown by including **well-developed** ideas with a **clear** appreciation of the different components and states of a sediment cell system. **Level 2 (3-5 marks)** Demonstrate **reasonable** knowledge and understanding of how a sediment cell be viewed as a system (AO1). This will be shown by including **developed** ideas with **some** appreciation of the different components and states of a sediment cell system. **Level 1 (1-2 marks)** Demonstrate **basic** knowledge and understanding of how a sediment cell be viewed as a system (AO1). This will be shown by including **simple** ideas with **no** or **limited** appreciation of the different components and states of a sediment cell system. **0 marks** No response or no response worthy of credit.	**8** **AO1** **x8**	**Indicative content:** **AO1 – 8 marks** A **thorough** answer is likely to fully explain the sediment cell as a system of inputs, processes and outputs, include detail of the closed and open facets of a coastal sediment cell system and show a good understanding of dynamic equilibrium and feedback A **reasonable** answer is likely to have some explanation of where the inputs into the system may have come from, will describe the processes and may have some indication of the outputs. It should include details of the closed facets of a coastal sediment cell A **basic** answer will understand that a system is made up of inputs, processes and outputs and may be able to describe the inputs and processes in the system. Out puts are unlikely to be discussed Knowledge and understanding of how a sediment cell can be viewed as a system could potentially include: • Sediment cells are a stretch of the coastline and the nearshore area where the movement of material is self-contained. • Therefore, sediment cells are generally considered closed systems where sediment is not transferred from one cell to another. • Closed system consists of stores (sediment e.g. beaches, estuaries and nearshore zone), transfers (movement of sediment e.g. longshore drift). • Inputs and outputs are largely restricted to energy • Boundaries are determined by the shape of the coastline and topography, which largely prevent the transfer of sediment to adjacent cells.

Question			Answer	Mark	Guidance
					• Sediment cells also can be considered as open systems through winds and tidal currents transferring some sediment between cells. • Sediment can be sourced from fluvial and marine deposition, weathering and mass movement of cliffs • Understanding of how a system can be considered to be in a state of equilibrium or dynamic equilibrium where positive feedbacks disturb and negative feedbacks restore the equilibrium. • Sediment cells operate on a range of spatial (cells within cells) and temporal scales (days to millennia).
1	(b)	(i) ✓ DEV	**Calculate the median for the data shown in Table 1. You must show your working.** Order of values from highest to lowest: 0.1, 0.4, 0.5, 0.6, 0.9, 1.0, 1.5, 2.0, 4.2 (DEV) Median value is 5th value = **0.9** (✓)	**2** **AO3** **x2**	**AO3 – 2 marks** 1 x 1 mark (✓) for correct answer. 1 x 1 mark (DEV) for showing working of calculation.
1	(b)	(ii) ✓ DEV	**Calculate the interquartile range for the data shown in Table 1. You must show your working.** 1) Lower quartile **= 0.45 (DEV)** 2) Upper quartile **= 1.75 (DEV)** 3) **Interquartile range = Upper quartile – Lower quartile/ = 1.75 – 0.45 (DEV)** 4) **= 1.3 (✓)**	**4** **AO3** **x4**	**AO2 – 4 marks** 1 x 1 mark (DEV) for identifying upper quartile value. 1 x 1 mark (DEV) for identifying lower quartile value. 1 x 1 mark (DEV) for showing correct calculation/formula to calculate IQR 1 x 1 mark (✓) for correct answer.

Question			Answer	Mark	Guidance
1	(c)	✓	**With reference to Fig. 1, explain the role of flows of materials in forming landform A.** Movement of materials from source to provide materials Movement of different materials across the landform Deposition of materials Modification of feature by variation in flows	**3** **AO2** **x3**	3 x 1 (✓) for analysing Fig. 1 to explain the role of flows of materials in forming landform A (the spit) Max 2 marks from any one section ✓Source: • Terrestrial (included weathering, mass movement and wind-blown materials from source outside Fig) • Fluvial inputs • Off shore ✓Movement of materials across the landform • Longshore drift of materials • Aeolian processes (saltation/traction) ✓Deposition of Materials • Loss of energy – so materials deposited • Sheltered side deposition • Possible development of salt marshes ✓Modification • Wind direction change /Wave refraction/secondary wave direction results in curved shape at the end of the spit.
1	(d)*	A1 L1 L2 L3 A2 L1	**Using a case study, assess the relative importance of the different physical factors influencing the landscape of a high energy coastline.** **AO1** **Level 3 (6-8 marks)** Demonstrates **comprehensive** knowledge and understanding of how physical factors influence the landscape of a high energy coastline. The answer should include **accurate place-specific** detail.	**16** **AO1** **x8** **AO2** **x8**	**Indicative content** **AO1 – 8 marks** Knowledge and understanding of how physical factors influence the landscape of a high energy coastline could potentially include: • Geology will likely influence the high energy coastline through differences in rock resistance affecting the rates of erosion, weathering and mass movement. Differences in rock resistance as a result of rock structure, alignment and lithology. • Shape of coastline and beach may influence marine processes such as wave refraction and therefore affect geomorphic processes.

Question			Answer	Mark	Guidance
		L2 L3 PLC	**Level 2 (3-5 marks)** Demonstrates **thorough** knowledge and understanding of how physical factors influence the landscape of a high energy coastline. The answer should include **place-specific** detail which is **partially accurate**. **Level 1 (1-2 marks)** Demonstrates **basic** knowledge and understanding of how physical factors influence the landscape of a high energy coastline. 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 importance of different physical factors have on influencing a landscape of a high energy coastline. **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		• The formation, development and breaking of different types of waves will influence the energy arriving at the coastline and where it is concentrated. This will be determined by weather conditions elsewhere, the fetch and the seabed topography. • Winds affect the waves arriving at the coastline through variations in their speed, direction and frequency. These will influence rates of geomorphic processes on different areas of the coastline. • Tidal cycles and ranges influence the areas affected spatially and temporally by different marine and subaerial processes. • Global pattern of ocean currents will influence the energy arriving at the coastline. • Physical factors influence geomorphic processes which in turn modify and form landforms. • Physical factors (e.g. geology of new coastline, shape of coastline etc.), and sediment budgets may also be modified by other physical factors. **AO2 – 8 marks** Apply knowledge and understanding to analyse and evaluate the relative importance of physical factors have on influencing a landscape of a high energy coastline could potentially include: • Assessment of the relative importance of physical factors on influencing the landscape, geomorphic processes and other physical factors in the landscape. • Influences may be creating new landforms, destroying, reshaping or modifying landforms. • Influences may be altering of the rate, scale and location of geomorphic processes. • Sediment budgets and inter-relationships between

Question			Answer	Mark	Guidance
			generalised judgements and conclusions, with limited use of evidence, of the relative importance of different physical factors have on influencing a landscape of a high energy coastline. **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 importance of different physical factors have on influencing a landscape of a high energy coastline. **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.		landforms may be influenced • Consideration of the "extent" could include scale (both spatially and temporally), significance and/or range of changes • The influence to the landscape system as a whole

Question			Answer	Mark	Guidance
2	(a)	A1 L1 L2 L3	**Explain how a glacier can be viewed as a system.** **Level 3 (6-8 marks)** Demonstrate **thorough** knowledge and understanding of how a glacier can be viewed as a system (AO1). This will be shown by including **well-developed** ideas with a **clear** appreciation of the different components and states of a glacier system. **Level 2 (3-5 marks)** Demonstrate **reasonable** knowledge and understanding of how a glacier can be viewed as a system (AO1). This will be shown by including **developed** ideas about how with **some** appreciation of the different components and states of a glacier system. **Level 1 (1-2 marks)** Demonstrate **basic** knowledge and understanding of how a glacier can be viewed as a system (AO1). This will be shown by including **simple** ideas with **no** or **limited** appreciation of the different components and states of a glacier system. **0 marks** No response or no response worthy of credit.	**8** **AO1** **x8**	**Indicative content:** **AO1 – 8 marks** • A **thorough** answer is likely to fully explain a glacier system of inputs, processes, stores and outputs, include detail of the open facets of this system, including zones of accumulation and ablation and an understanding of mass balance. It should show a good understanding of dynamic equilibrium and feedback, including seasonality • A **reasonable** answer is likely to have some explanation of where the inputs into the system have come from, will describe the processes and the outputs and may discuss stores. It should include an understanding of the open nature of the system • A **basic** answer will understand that a system is made up of inputs, processes and outputs and may be able to describe the inputs and processes and/or stores and outputs in the system. Equilibrium may be discussed • Knowledge and understanding of how a glacier can be viewed as a system could potentially include: • Glaciers are generally considered open systems with external inputs and outputs of energy and materials. • Open system inputs include energy, material (from deposition, weathering and mass movement), and precipitation (accumulation of snow) • Open system stores include ice, water and debris accumulations • Open system transfers include movement of ice, water and debris downslope under gravity • Open system outputs include glacial and wind erosion from rock surfaces, evaporation, sublimation, meltwater and calving

Question			Answer	Mark	Guidance
					• Understanding of how a system can be considered to be in a state of equilibrium or dynamic equilibrium where positive feedbacks disturb and negative feedbacks restore the equilibrium. • Understanding how glacier mass balance affects the state of equilibrium: difference between accumulation and ablation occurring in a glacier over a year. • Majority of inputs occur in the accumulation zone (upper parts of the glacier) where accumulation exceeds ablation. • Majority of outputs occur in ablation zone (lower parts of the glacier) where ablation exceeds accumulation. • Equilibrium line divides the ablation and accumulation zone. • Positive mass balance will see glacier and equilibrium line advance, negative mass balance will see glacier and equilibrium line retreat, whilst if the glacier is in equilibrium it will remain in a stable position. • Glaciers operate on a range of spatial and temporal scales. • Most likely temporal scales to be discussed include seasonal and annual changes, or changes over longer period of time due to climate change.
2	**(b)**	**(i)** ✓ DEV	**Calculate the median for the data shown in Table 2. You must show your working.** Median value is 5th value = **23 (✓)**	**2** **AO3** **x2**	**AO3 – 2 marks** 1 x 1 mark (✓) for correct answer. 1 x 1 mark (DEV) for showing working of calculation. Credit any correct method used to calculate the median e.g.

Question			Answer	Mark	Guidance
					Order of values from highest to lowest: 11, 14, 18, 20, 23, 34, 44, 49, 74 (DEV) (n+1)/2 (DEV)
2	(b)	(ii) ✓ DEV	**Calculate the interquartile range for the data shown in Table 2. You must show your working** 1) Lower quartile = **16 (DEV)** 2) Upper quartile = **46.5 (DEV)** 3) **Interquartile range = Upper quartile – Lower quartile/ = 46.5 – 16** 4) **= 30.5 (✓)**	**4 AO3 x4**	**AO3 – 4 marks** 1 x 1 mark (DEV) for identifying upper quartile value. 1 x 1 mark (DEV) for identifying lower quartile value. 1 x 1 mark (DEV) for showing correct calculation/formula to calculate IQR 1 x 1 mark (✓) for correct answer.
2	(c)	✓	**With reference to Fig. 2, explain the role of flows of materials in forming landform B.** Movement of materials from source to provide materials Movement of different materials across the landform Deposition of materials Modification of feature by variation in flows	**3 AO2 x3**	3 x 1 (✓) for analysing Fig. 1 to explain the role of flows of materials in forming landform B (the lateral moraine) Max 2 marks from any one section ✓Source: • Terrestrial (including weathering - freeze-thaw / frost shattering) and mass movement • Avalanches • Glacial erosion ✓Movement of materials across the landform • Movement of materials on surface/side of the glacier ✓Deposition of Materials • Loss of energy – so materials deposited (melting ice) • Glacial retreat ✓Modification • Rock slides modify the gradient of the moraine • Movement of material by meltwater

Question			Answer	Mark	Guidance
2	(d)*	A1 L1 L2 L3 A2 L1 L2 L3 PLC	**Using a case study, assess the relative importance of the different physical factors influencing a landscape shaped by the action of ice sheets.** **AO1** **Level 3 (6-8 marks)** Demonstrates **comprehensive** knowledge and understanding of how physical factors influence a landscape shaped by the action of ice sheets. The answer should include **accurate place-specific** detail. **Level 2 (3-5 marks)** Demonstrates **thorough** knowledge and understanding of how physical factors influence a landscape shaped by the action of ice sheets. The answer should include **place-specific** detail which is **partially accurate**. **Level 1 (1-2 marks)** Demonstrates **basic** knowledge and understanding of how physical factors influence a landscape shaped by the action of ice sheets. 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	**16** **AO1** **x8** **AO2** **x8**	**Indicative content** **AO1 – 8 marks** Knowledge and understanding of how physical factors influence a landscape shaped by the action of ice sheets could potentially include: • Geology will likely influence the landscape through differences in rock resistance (due to lithology and structure) affecting the rates of erosion. • Climatic change will initiate growth of ice sheet and lead to its eventual retreat • Climate (temperature and precipitation) will influence the rate and type of movement of the ice sheet, and the rate of erosion through the thickness of the ice sheet. • Latitude and altitude will influence the climate and therefore the development and growth of ice sheets. • Ice sheet retreat can cause isostatic readjustment, which can lead to modification of landforms • Physical factors influence geomorphic processes which in turn modify and form landforms. • Physical factors (e.g. climate) may also be modified by other physical factors. **AO2 – 8 marks** Apply knowledge and understanding to analyse and evaluate the relative importance of physical factors

Question			Answer	Mark	Guidance
			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 importance of different physical factors have on influencing a landscape shaped by the action of ice sheets. **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 importance of different physical factors have on influencing a landscape shaped by the action of ice sheets. **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 importance of different physical factors have on influencing a landscape shaped by the action of ice sheets. **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.		have on influencing a landscape shaped by the action of ice sheets could potentially include: • Assessment of the relative importance of physical factors on influencing the landscape, geomorphic processes and other physical factors in the landscape. • Influences may be creating new landforms, destroying, reshaping or modifying landforms. • Influences may be altering of the rate, scale and location of geomorphic processes. • Inter-relationships between landforms may be influenced. • Consideration of the “extent” could include scale (both spatially and temporally), significance and/or range of changes. • The influence to the landscape system as a whole.

Question			Answer	Mark	Guidance
			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.		
3	**(a)**	**A1** L1 L2 L3	**Explain how a polar dryland can be viewed as a system.** **Level 3 (6-8 marks)** Demonstrate **thorough** knowledge and understanding of how a polar dryland can be viewed as a system (AO1). This will be shown by including **well-developed** ideas with a **clear** appreciation of the different components and states of a polar dryland system. **Level 2 (3-5 marks)** Demonstrate **reasonable** knowledge and understanding of how a polar dryland can be viewed as a system (AO1). This will be shown by including **developed** ideas with **some** appreciation of the different components and states of a polar dryland system. **Level 1 (1-2 marks)** Demonstrate **basic** knowledge and understanding of how a polar dryland can be viewed as a system (AO1).	**8** **AO1** **x8**	**Indicative content:** **Antarctic and High Arctic Tundra can be credited** **AO1 – 8 marks** • A **thorough** answer is likely to fully explain a polar dryland system of inputs, processes, stores and output. It should include detail of the open facets of this system. It should show a good understanding of dynamic equilibrium and feedback, including seasonality • A **reasonable** answer is likely to have some explanation of where the inputs into the system have come from, will describe the processes and the outputs and may discuss stores. It should include an understanding of the open nature of the system • A **basic** answer will understand that a system is made up of inputs, processes and outputs and may be able to describe the inputs and processes and/or stores and outputs in the system. Equilibrium may be discussed

Question			Answer	Mark	Guidance
			This will be shown by including **simple** ideas with **no** or **limited** appreciation of the different components and states of a polar dryland system. **0 marks** No response or no response worthy of credit.		Knowledge and understanding of how a polar dryland can be viewed as a system could potentially include: • Polar drylands are considered open systems. • Open system inputs include energy (solar radiation) and precipitation. • Open system stores include ice, water and sediment accumulations • Open system transfers include movement of water and sediment • Open system outputs include heat (longwave radiation from the surface), evapotranspiration, stream flow, erosion and transport of sediment material by rivers and winds • Understanding of how a system can be considered to be in a state of equilibrium or dynamic equilibrium where positive feedbacks disturb and negative feedbacks restore the equilibrium. • Polar drylands are concentrated north of tundra so for much of the year the water is frozen, resulting in seasonal variations in the movement of water in the system. • During brief Arctic summer melting will occur causing streams to flow from snow patches. • Weathering and erosion are key processes breaking down rock to be transported and deposited within and outside the polar drylands system. • Freeze-thaw weathering is most active in producing material in the system during spring and autumn months when diurnal temperatures fluctuate above and below freezing. • Mass movement (solifluction) of soil and regolith in the active layer will occur in the summer.

Question			Answer	Mark	Guidance
					• Polar drylands operate on a range of spatial and temporal scales.
3	(b)	(i) ✓ DEV	**Calculate the median for the data shown in Table 3. You must show your working.** Order of values from highest to lowest: 154, 202, 391, 460, 658, 877, 900, 1,350, 1,351 (DEV) Median value is 5th value = **658 (✓)**	**2 AO3 x2**	**AO3 – 2 marks** 1 x 1 mark (✓) for correct answer. 1 x 1 mark (DEV) for showing working of calculation.
3	(b)	(ii) ✓ DEV	**Calculate the interquartile range for the data shown in Table 3. You must show your working.** 1) Lower quartile **= 296.5 (DEV)** 2) Upper quartile **= 1125 (DEV)** 3) **Interquartile range = Upper quartile – Lower quartile/ = 1125 – 296.5 (DEV)** 4) **= 828.5 (✓)**	**4 AO3 x4**	**AO3 – 4 marks** 1 x 1 mark (DEV) for identifying upper quartile value. 1 x 1 mark (DEV) for identifying lower quartile value. 1 x 1 mark (DEV) for showing correct calculation/formula to calculate IQR 1 x 1 mark (✓) for correct answer.
3	(c)	✓	**With reference to Fig. 3, explain the role of flows of materials in forming landform C.** Movement of materials from source to provide materials Movement of different materials across the landform Deposition of materials Modification of feature by variation in flows	**3 AO2 x3**	3 x 1 (✓) for analysing Fig. 1 to explain the role of flows of materials in forming landform B (the alluvial fan) Max 2 marks from any one section ✓Source: • Terrestrial (including weathering) and mass movement • Subaerial erosion ✓Movement of materials across the landform • Movement of materials by fluvial processes • Movement of materials by aeolian processes

Question			Answer	Mark	Guidance
					✓Deposition of Materials • Loss of energy – so materials deposited – due to change in slope angle • Loss of energy – so materials deposited – due to infiltration of water • Grading of sediment ✓Modification • Rock slides modify the gradient of the fan • Movement of material by fluvial processes • Movement of material by aeolian processes • Fluvial transportation provides material for the deposition of alluvium. • Precipitation provides water for surface runoff and water for ephemeral streams to form to transport material to the alluvial fan. • Increased material load in the ephemeral streams will result in deposition of alluvium when a river enters a lowland area. • Deposition of alluvium results in the initial formation of the alluvial fan over time and the growth of the delta-shaped alluvial fan. • Transportation of smaller material further on the alluvial fan results in sediment grading on alluvial fan. • Aeolian erosion and weathering provides material for ephemeral streams to transport material to the alluvial fan.

Question			Answer	Mark	Guidance
3	(d)*	A1 L1 L2 L3 A2 L1 L2 L3 PLC	**Using a case study, assess the relative importance of the different physical factors influencing the landscape of a mid-latitude desert.** **AO1** **Level 3 (6-8 marks)** Demonstrates **comprehensive** knowledge and understanding of how physical factors influence the landscape of a mid-latitude desert. The answer should include **accurate place-specific** detail. **Level 2 (3-5 marks)** Demonstrates **thorough** knowledge and understanding of how physical factors influence the landscape of a mid-latitude desert. The answer should include **place-specific** detail which is **partially accurate**. **Level 1 (1-2 marks)** Demonstrates **basic** knowledge and understanding of how physical factors influence the landscape of a mid-latitude desert. 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	**16** **AO1** **x8** **AO2** **x8**	**Indicative content** **AO1 – 8 marks** Knowledge and understanding of how physical factors influence the landscape of a mid-latitude desert could potentially include: • Geology will influence the mid-latitude desert through differences in rock resistance affecting the rates of erosion, weathering and mass movement. Differences in rock resistance as a result of rock structure, alignment and lithology. • Relief and aspect will influence rates of geomorphic processes, through creating microclimates. • Climate (temperature and precipitation) will influence the rate, scale and type of geomorphic processes. The increased and more regular presence of water in mid-latitude deserts likely to see mechanical weathering dominate, and chemical and biological weathering increase. Other processes (e.g. aeolian processes) maybe less effective. • Latitude and altitude will influence the climate and therefore the geomorphic processes. • Availability of sediment will influence sediment budgets, and erosion processes. • Physical factors influence geomorphic processes which in turn modify and form landforms. • Physical factors (e.g. availability of sediment) may also be modified by other physical factors. **AO2 – 8 marks** Apply knowledge and understanding to analyse and evaluate the relative importance of physical factors have on influencing a landscape of a mid-latitude desert

Question			Answer	Mark	Guidance
			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 importance of different physical factors have on influencing a landscape of a mid-latitude desert. **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 importance of different physical factors have on influencing a landscape of a mid-latitude desert. **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 importance of different physical factors have on influencing a landscape of a mid-latitude desert. **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.		could potentially include: • Assessment of the relative importance of physical factors on influencing the landscape, geomorphic processes and other physical factors in the landscape. • Influences may be creating new landforms, destroying, reshaping or modifying landforms. • Influences may be altering of the rate, scale and location of geomorphic processes. • Sediment budgets and inter-relationships between landforms may be influenced • Consideration of the "extent" could include scale (both spatially and temporally), significance and/or range of changes • The influence to the landscape system as a whole

Question			Answer	Mark	Guidance
			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.		
4	**(a)**	**(i)** ✓ DEV	**With reference to Fig. 4, suggest how variations in precipitation totals influence runoff processes in the water cycle.** ✓ more **total precipitation** leads to more run off in the East ✓ more **intense precipitation** leads to more run off in the West ✓ less **total precipitation** leads to less surface run off in the West DEV Prolonged rainfall fills the soil spaces with water/soil is saturated Soil acts as though it is impermeable/this means water can't infiltrate **Saturated overland flow** then takes place Heavy rainfall can exceed infiltration capacity Previous weather conditions affect infiltration capacity **Infiltration excess overland flow** then takes place Less rainfall means ground is not saturated Infiltration can occur when rainfall is light or not intense	**4** **AO2 x 4**	**AO2 – 4 marks** 1 x 1 mark (✓) for interpretation of the map in Fig. 4 to suggest an appropriate runoff process. Interpretation could include locations or data. 3 x 1 (DEV) for justification of this runoff process. When candidates distinguish between the different types of overland flow, this is a good discriminator at the top end. Credit all valid points Do NOT credit direct mirroring, but further development may be valid

Question			Answer	Mark	Guidance
			Less surface run off can mean more groundwater storage and throughflow		
4	(a)	(ii) ✓	**Explain three limitations of presenting rainfall data using choropleth maps.** Abrupt changes can occur at boundaries between adjoining areas which are not reflected in reality (✓) Areal units can vary in size and shape with excessive generalisations created in large areas (✓) There is an assumption that a whole area shaded the same has the same level of precipitation, when it hides the actual distribution of values (✓) Difficulty in interpreting the values of areal units due to the sliding colour variations in the key (✓)	**3** **AO3** **x3**	**AO3 – 3 marks** 3 x 1 (✓) for three limitations of presenting rainfall data using choropleth maps. Do NOT Credit • Points regarding the usefulness of data – the question is about the method of presentation • Colour without reference to the key
4	(b)	SEEN L1 L2 L3	**Examine how feedback loops can affect the processes and stores within the carbon cycle.** **Level 3 (7-10 marks)** Demonstrates **comprehensive** knowledge and understanding of how positive and negative feedback loops can affect both the processes and stores within the carbon cycle (AO1). Demonstrates **comprehensive** application of knowledge and understanding to provide a detailed account of how feedback loops can affect both the processes and stores within the carbon cycle (AO2). This will be shown by including **well-developed** ideas with a balance between positive and negative feedback processes and how they affect both the processes and stores within the carbon cycle.	**10** **AO1 5** **AO2 5**	**Indicative content** **AO1 – 5 marks** Knowledge and understanding of how feedback loops can affect the processes and stores within the carbon cycle could potentially include: • feedback loops either enhance (positive feedback loops) or counter (negative feedback loops) changes in the carbon cycle • Positive feedback loops • as temperatures rise, the rate of organic matter decomposition rises, this releases more CO_2 into the atmosphere which traps outgoing solar radiation and warms the atmosphere and so on. Carbon is transferred from the biosphere to the atmosphere, increasing the carbon stored in the atmosphere

Question			Answer	Mark	Guidance
			Level 2 (4-6 marks) Demonstrates **thorough** knowledge and understanding of how positive and negative feedback loops can affect both the processes and stores within the carbon cycle (AO1). Demonstrates **thorough** application of knowledge and understanding to provide a detailed account of how feedback loops can affect both the processes and stores within the carbon cycle (AO2). This will be shown by including **developed** ideas with some balance between positive and negative feedback processes and how they affect both the processes and stores within the carbon cycle. **Level 1 (1–3 marks)** Demonstrates **basic** knowledge and understanding of how feedback loops can affect both the processes and stores within the carbon cycle (AO1). Demonstrates **basic** application of knowledge and understanding to provide an account of how feedback loops can affect the processes and stores within the carbon cycle (AO2). This will be shown by including **some** ideas about feedback processes and how they affect the processes and/or stores within the carbon cycle. **0 marks** No response or no response worthy of credit.		• as temperatures rise, permafrost is melted, exposing warmer soils and organic matter begins to decompose, releasing CO_2 into the atmosphere and enhancing the greenhouse effect. Carbon is transferred from the biosphere to the atmosphere, increasing the carbon stored in the atmosphere • as temperatures rise, snow and ice is melted. This exposes more rock and darker surfaces, lowering the albedo rate. More solar radiation is absorbed by the ground and warms the atmosphere. Carbon is transferred from the biosphere to the atmosphere, increasing the carbon stored in the atmosphere • higher levels of atmospheric CO_2 should encourage photosynthesis by phytoplankton, however as temperatures rise and warm the oceans, the amount of phytoplankton could decrease as they prefer to thrive in cool, nutrient-rich waters, the ocean is a less efficient carbon sink. More CO_2 remains stored in the atmosphere and enhances the greenhouse effect • Negative feedback loops • higher levels of CO_2 encourage photosynthesis (carbon fertilisation) by plants as long as there are no other limiting factors to growth. This converts CO_2 into carbon sinks such as forests and reduces the amount of CO_2 in the atmosphere. Carbon is transferred from the atmosphere to the biosphere, increasing the carbon stored in the biosphere. **AO2 – 5 marks** Apply knowledge and understanding to provide a detailed account of how feedback loops can affect both the processes and stores within the carbon cycle could potentially include: • natural processes and human activities can cause

Question			Answer	Mark	Guidance
					change in the flows and stores within the carbon cycle, feedback is an automatic response to these changes. The global carbon cycle is currently in disequilibrium with more carbon dioxide in the atmosphere as a result of the burning of fossil fuels • due to the rate at which fossil fuels are being burnt, positive feedback loops have a disproportionate effect on the processes and stores within the carbon cycle. They could intensify the carbon cycle, speeding up decomposition and adding more carbon dioxide to the atmosphere, therefore enhancing the greenhouse effect and causing further changes in the system • negative feedback could neutralise rising levels of carbon dioxide in the atmosphere by stimulating photosynthesis and increasing the amount of carbon extracted from the atmosphere and stored in the biosphere (to be returned to soil and ocean sediments), therefore lessening the greenhouse effect and restoring equilibrium to the system.
4	(c) *	A1 L1 L2 L3 A2 L1 L2	**Assess the extent to which deforestation and farming affect the water and carbon cycles of a tropical rainforest.** **AO1** **Level 3 (6–8 marks)** Demonstrates **comprehensive** knowledge and understanding of the effects of deforestation and farming on the water and carbon cycles of a tropical rainforest. The answer should include **accurate place-specific detail**. **Level 2 (3–5 marks)**	**16** **AO1 8** **AO2 8**	**Indicative content** **AO1 – 8 marks** Knowledge and understanding of the effects of deforestation and farming on the water and carbon cycles of a tropical rainforest could potentially include: • deforestation depletes the carbon biomass store, if wood is burnt then CO_2 is released into the atmosphere • where forests are replaced with pasture, less solar radiation is absorbed and more CO_2 remains in the atmosphere • where forests are replaced with pasture, less water is stored in the soil or biosphere and less is available for evaporation

Question			Answer	Mark	Guidance
		L3 PLC	Demonstrates **thorough** knowledge and understanding of the effects deforestation and farming on the water and carbon cycles of a tropical rainforest. The answer should include **some place-specific detail which is partially accurate**. **Level 1 (1–2 marks)** Demonstrates **basic** knowledge and understanding of the effects of deforestation and farming on the water and carbon cycles of a tropical rainforest. 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 deforestation and farming affect the water and carbon cycles 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 deforestation and farming affect the water and carbon cycles is sound but partial. Judgements are generalised		• tree roots move water to the surface producing greater humidity. Fewer trees, a result of deforestation, results in less humid air, lower evapotranspiration rates and less precipitation • where forests are replaced with pasture, less organic matter is stored in the soil, therefore soils tend to be thinner and less able to store water, flashier floods are more likely • deforestation affects albedo and ground temperatures, temperatures can rise by more than 5°C when forest is replaced by pasture • when forest is replaced by pasture, drier soils are eroded by the wind; carbon stored in the soil is transferred to the atmosphere • the extent of the impact will depend on the scale of changes to the tropical rainforest and what the forest is replaced with. Palm oil plantations may not affect the water and carbon cycles to the same degree as cattle ranching • deforestation can affect climate at a local and regional scale, resulting in regional drought and declining rainfall in downwind locations. **AO2 – 8 marks** Apply knowledge and understanding to analyse and evaluate the extent to which deforestation and farming affect the water and carbon cycles of a tropical rainforest could potentially include: • both deforestation and farming practices in tropical rainforests disturb the rates of flow and distinctive stores in the water cycle, this includes disturbances to physical factors including temperature, rock permeability and porosity and relief. Disturbances include the reduction in trees reduces water storage in forest trees and eroded soils, fewer trees mean

Question			Answer	Mark	Guidance
			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 deforestation and farming affect the water and carbon cycles is weak or absent. Judgements, if present, are unsupported leading to simple conclusions. **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.		less evapotranspiration and less precipitation • both deforestation and farming practices in tropical rainforests disturb the rates of flow and distinctive stores in the carbon cycle, this includes disturbances to physical factors including temperature, vegetation, organic matter in soil and the mineral composition of rocks. Disturbances include the reduction in input of organic material to the soil, reduction in carbon stored in the biomass of trees and leaching of nutrients out of soils no longer protected by tree roots • disturbing the water cycle (flows and stores) and the carbon cycle (carbon flows, soils and nutrient stores) in tropical rainforests, in turn influences the dynamic equilibrium in the cycles and the balance between the stores and flows • a tropical rainforest is a living, dynamic system. Positive feedback loops within and between the water and carbon cycles can cause further change in the system increasing the impact of deforestation and farming. Negative feedback loops within and between the water and carbon cycles can counter change in the system reducing the impact of deforestation and farming and restoring the equilibrium • consideration of the 'extent' could include scale, significance and/or range of the effects of deforestation and farming on the water and carbon cycles, for example palm oil plantations may not affect the cycles to the same degree as cattle ranching • the significance of deforestation and farming activities to the tropical rainforest system as a whole.

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