A-level
GEOGRAPHY
7037/1

Paper 1 Physical geography

Mark scheme

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Mark schemes are prepared by the Lead Assessment Writer and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation events which all associates participate in and is the scheme which was used by them in this examination. The standardisation process ensures that the mark scheme covers the students' responses to questions and that every associate understands and applies it in the same correct way. As preparation for standardisation each associate analyses a number of students' scripts. Alternative answers not already covered by the mark scheme are discussed and legislated for. If, after the standardisation process, associates encounter unusual answers which have not been raised they are required to refer these to the Lead Examiner.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of students' reactions to a particular paper. Assumptions about future mark schemes on the basis of one year's document should be avoided; whilst the guiding principles of assessment remain constant, details will change, depending on the content of a particular examination paper.

Further copies of this mark scheme are available from aqa.org.uk

Level of response marking instructions

Level of response mark schemes are broken down into levels, each of which has a descriptor. The descriptor for the level shows the typical performance for the level. There are marks in each level.

Before you apply the mark scheme to a student's answer read through the answer and annotate it (as instructed) to show the qualities that are being looked for. You can then apply the mark scheme.

The notes for answers provide indicative content. Students' responses may take a different approach in relation to that which is typical or expected. It is important to stress that examiners must consider all a student's work and the extent to which this answered the question, irrespective of whether a response follows an expected structure. If in doubt the examiner should contact their team leader for advice and guidance.

Step 1 Determine a level

Start at the lowest level of the mark scheme and use it as a ladder to see whether the answer meets the descriptor for that level. The descriptor for the level indicates the different qualities that might be seen in the student's answer for that level. If it meets the lowest level then go to the next one and decide if it meets this level, and so on, until you have a match between the level descriptor and the answer. With practice and familiarity you will find that for better answers you will be able to quickly skip through the lower levels of the mark scheme.

When assigning a level you should look at the overall quality of the answer and not look to pick holes in small and specific parts of the answer where the student has not performed quite as well as the rest. If the answer covers different aspects of different levels of the mark scheme you should use a best fit approach for defining the level and then use the variability of the response to help decide the mark within the level, i.e. if the response is predominantly level 3 with a small amount of level 4 material it would be placed in level 3 but be awarded a mark near the top of the level because of the level 4 content.

Step 2 Determine a mark

Once you have assigned a level you need to decide on the mark. The descriptors on how to allocate marks can help with this. The exemplar materials used during standardisation will help. There will be an answer in the standardising materials which will correspond with each level of the mark scheme. This answer will have been awarded a mark by the Lead Examiner. You can compare the student's answer with the example to determine if it is the same standard, better or worse than the example. You can then use this to allocate a mark for the answer based on the Lead Examiner's mark on the example.

You may well need to read back through the answer as you apply the mark scheme to clarify points and assure yourself that the level and the mark are appropriate.

Indicative content in the mark scheme is provided as a guide for examiners. It is not intended to be exhaustive and you must credit other valid points. Students do not have to cover all of the points mentioned in the indicative content to reach the highest level of the mark scheme.

An answer which contains nothing of relevance to the question must be awarded no marks.

Explanation of annotations

Annotation	Meaning/Use
?	Unclear
[	Left square bracket
]	Right square bracket
^	Omission mark
Acc?	Poor accuracy
AO1	Assessment Objective 1
AO2	Assessment Objective 2
AO3	Assessment Objective 3
DP	Developed point
H Line	Incorrect
JUST	Level or point just awarded
L1	Level 1
L2	Level 2
L3	Level 3
L4	Level 4
NAQ	Not answered the question
NC	Nothing Creditworthy
SEEN	Reviewed but no marks awarded
Tick	Correct point
TV	Too vague
V Wavy	Not relevant/incorrect
Highlight	Highlight
On Page Comment	On Page Comment
Off Page Comment	Off Page Comment

Section A

Question 1 Water and carbon cycles

Qu	Part	Marking guidance	Total marks
01	1	**Outline flows within the water cycle operating on a hill slope.** Point marked Allow 1 mark per valid point with extra mark(s) for developed points (d). For example: Notes for answers • Surface runoff occurs when water runs directly over the ground (1) This may occur if the soil is saturated (or flow over impermeable surfaces). (1)(d) • Infiltration occurs when the water moves from the surface and then down through the soil horizons (1) until it reaches the groundwater or an impermeable layer in the soil (1) (d). • Throughflow occurs when, under the force of gravity, water moves downslope through the soil until it reaches a water body (1). This movement is usually very slow due to the frictional effect of the soil particles (1) (d). • Groundwater flow is the movement of water through permeable rock under the force of gravity (1). This is the slowest flow of water on a hillslope (1) (d). Other types of flow may also be considered e.g. percolation, stemflow Allow 1 + 1 if appropriately defined and elaborated. Must offer more than one flow for full marks. Allow 1 mark for a list of two or more processes. The Notes for answers are not exhaustive. Credit any valid points.	**4** **AO1=4**
01	2	**Analyse the data shown in Figure 1** **AO3** – There should be clear analysis of the relationships between rainfall in the drainage basin and its impact upon the simulated hydrograph. There should also be data manipulation to support the analysis. The relationship between the simulation and actual hydrograph should also be analysed. Mark scheme **Level 2 (4–6 marks)** **AO3** – Clear analysis of the quantitative evidence provided, which makes appropriate use of data in support. Clear connection(s) between different aspects of the data and evidence.	**6** **AO3=6**

		Level 1 (1–3 marks) **AO3** – Basic analysis of the quantitative evidence provided, which makes limited use of data and evidence in support. Basic connection(s) between different aspects of the data and evidence. Notes for answers **AO3** Level 1 responses are likely to simply describe the data without clear attempt to analyse, for instance by manipulating data, identifying relationships and/or spotting trends. • The first round of rainfall appears to make little impact on either the measured or simulated discharge. Rainfall peaks at 2 mm and the event appears to last around 4–5 hours. Discharge remains at between 1–2 m^3/sec. The simulated discharge appears to show some response to the event with a sharp rise and quick return to below normal baseflow within 4–5 hours. It is the measured flow which shows very little response to the event. • However, by around 6 pm on 14.04.07 there is a very strong and almost immediate increase in discharge. Discharge increases by almost 7 m^3/sec with virtually no build up prior to this. The simulated data shows more of a lag – around 3–4 hours, a sharp increase but a lower peak perhaps up to 1 m^3/sec less. Some may question the reliability of the simulation in predicting the impact of the first event. • The second event appears to start around 6pm on 14.04.07 and last around 10 hours. The lag time is longer for both the measured and simulated discharge. The peak is also lower at around 6.6 m^3/sec. The simulation is even less accurate following the second event. The peak is lower than the measured flow by over 2 m^3/sec and the return to base flow is less pronounced. Credit any other valid analysis.	

01	3	**Using Figure 2a, Figure 2b and your own knowledge, assess the potential impact of changing vegetation cover upon the runoff in this area.** **AO1** – Knowledge and understanding of changes in the water cycle over time to include natural variation including storm events, seasonal changes, and human impact including farming practices, land use change and water abstraction. **AO2** – Application of knowledge to show an understanding of impact of changing the natural vegetation in an area and the impact that this might have upon the novel situation. Mark scheme **Level 2 (4–6 marks)** **AO1** – Demonstrates clear knowledge and understanding of concepts,	**6** **AO1=2** **AO2=4**

processes, interactions and change.
AO2 – Applies knowledge and understanding to the novel situation offering clear evaluation and analysis drawn appropriately from the context provided. Connections and relationships between different aspects of study are evident with clear relevance.

Level 1 (1–3 marks)
AO1 – Demonstrates basic knowledge and understanding of concepts, processes, interactions, change.
AO2 – Applies limited knowledge and understanding to the novel situation offering only basic evaluation and analysis drawn from the context provided. Connections and relationships between different aspects of study are basic with limited relevance.

Notes for answers
AO1

- Changes in the water cycle over time to include natural variation including storm events, seasonal changes and human impact including farming practices, land use change and water abstraction.
- The knowledge of a case study of a tropical rainforest setting to illustrate and analyse key themes in water and carbon cycles and their relationship to environmental change and human activity.

AO2

- Variation in runoff volume is a product of a number of factors. These include antecedent rainfall, vegetation cover, underlying bedrock and relief. Human activity is also a significant factor.
- The resource provides only limited information about the area. It is clear that where forest is replaced by mixed vegetation, grassland, built up areas or bare soil, runoff is likely to increase. In 2001, for most areas within the watershed, the run off has increased compared to 1976. This is best exemplified with areas 5, 6 and 11.
- The removal of forest is likely to lead to decreased canopy, less interception, reduced transpiration and possibly soil compaction depending upon how the land is subsequently used. Area 6 is a good example of this.
- However, there is no information provided about precipitation levels or relief. For example, in areas 1 and 2 there is little variation between the periods or the rehabilitated condition.
- There are only two or three areas where the removal of vegetation appears to have had a significantly detrimental impact upon runoff.
- In the rehabilitated area, runoff is lower suggesting increased interception and evapotranspiration. In area 10, the mixed vegetation appears to have reduced the runoff substantially. Similarly area 6 has appears to have undergone significant rehabilitation and this has reduced runoff to below the rates seen in 2007.

Credit any other valid assessment.

01	4	**To what extent does an understanding of feedback systems in the carbon cycle help with attempts to mitigate the impacts of climate change?** **AO1** – An understanding of feedback systems within the carbon cycle. An awareness of strategies involved reducing carbon levels in the atmosphere. **AO2** – Application of knowledge and understanding to show the extent to which understanding of feedback systems in the carbon cycle contribute to mitigation strategies. <u>Notes for answers</u> **AO1** • Global distribution, and size of major stores of carbon – lithosphere, hydrosphere, cryosphere biosphere, atmosphere. Factors driving change in the magnitude of these stores over time and space, including flows and transfers at plant, sere and continental scales. • Photosynthesis, respiration, decomposition, combustion, carbon sequestration in oceans and sediments, weathering. • Changes in the carbon cycle over time, to include natural variation (including wild fires, volcanic activity) and human impact (including hydrocarbon fuel extraction and burning, farming practices, deforestation, land use changes). • The carbon budget and the impact of the carbon cycle upon land, ocean and atmosphere, including global climate. • The role of feedbacks within and between cycles and their link to climate change and implications for life on Earth. • Human interventions in the carbon cycle designed to influence carbon transfers and mitigate the impacts of climate change. **AO2** • Some may first define the concept of feedback. In this context, feedback is concerned with the interconnectedness of change processes in the carbon cycle. With positive feedback impacts can be exacerbated once climate change starts to occur as natural processes tend to compound one another, increasing climatic instability and the likelihood of extreme conditions. In contrast, negative feedback is likely to have a more stabilising impact by depressing rates of the natural processes and moderating rates of atmospheric change. • For example, increasing global temperatures will extend growing seasons for plants and lead to increased carbon capture (negative feedback). Equally though increasing global temperatures will release methane from permafrost locations adding more greenhouse gasses to the atmosphere (positive feedback). • Many will argue that current rates of greenhouse gas emissions are creating a net positive feedback i.e. creating greater instability in climate change and exacerbating the warming. In this sense, the knock-on effect of increased carbon emissions from human activity is also increasing the natural release of carbon and methane. • The obvious way in which an understanding of feedback translates into policy is through afforestation schemes. Clearly by planting natural	**20** **AO1=10** **AO2=10**

		vegetation or allowing previously deforested areas to regain natural vegetation, the natural creation of carbon sinks begins. • Other mitigation strategies clearly take into account the role of feedback. Expect to see reference to carbon sequestration and storage. This strategy again shows a clear understanding of the role of feedback. • Some may argue in more general terms a very simple point, if carbon increases are linked to global warming and this is damaging for the environment, then irrespective of an understanding of feedback, human endeavour should be geared towards reducing the amount of carbon produced as a result of energy use and other human activity. This argument may be linked to measures to reduce carbon emissions, which in itself is not driven by an understanding of feedback systems. This is a legitimate approach. Credit any other valid approach.	

Marking grid for Question 1.4

Level/ Mark Range	Criteria/Descriptor
Level 4 (16–20 marks)	• Detailed evaluative conclusion that is rational and firmly based on knowledge and understanding which is applied to the context of the question. Interpretations are comprehensive, sound and coherent (AO2). • Detailed, coherent and relevant analysis and evaluation in the application of knowledge and understanding throughout (AO2). • Full evidence of links between knowledge and understanding to the application of knowledge and understanding in different contexts (AO2). • Detailed, highly relevant and appropriate knowledge and understanding of place(s) and environments used throughout (AO1). • Full and accurate knowledge and understanding of key concepts, processes and interactions and change throughout (AO1). • Detailed awareness of scale and temporal change which is well integrated where appropriate (AO1).
Level 3 (11–15 marks)	• Clear evaluative conclusion that is based on knowledge and understanding which is applied to the context of the question. Interpretations are generally clear and support the response in most aspects (AO2). • Generally clear, coherent and relevant analysis and evaluation in the application of knowledge and understanding (AO2). • Generally clear evidence of links between knowledge and understanding to the application of knowledge and understanding in different contexts (AO2). • Generally clear and relevant knowledge and understanding of place(s) and environments (AO1). • Generally clear and accurate knowledge and understanding of key concepts, processes and interactions and change (AO1). • Generally clear awareness of scale and temporal change which is integrated where appropriate (AO1).

Level 2 (6–10 marks)	• Some sense of an evaluative conclusion partially based upon knowledge and understanding which is applied to the context of the question (AO2). Interpretations are partial but do support the response in places. • Some partially relevant analysis and evaluation in the application of knowledge and understanding (AO2). • Some evidence of links between knowledge and understanding to the application of knowledge and understanding in different contexts (AO2). • Some relevant knowledge and understanding of place(s) and environments which is partially relevant (AO1). • Some knowledge and understanding of key concepts, processes and interactions and change. There may be a few inaccuracies (AO1). • Some awareness of scale and temporal change which is sometimes integrated where appropriate. There may be a few inaccuracies (AO1).
Level 1 (1–5 marks)	• Very limited and/or unsupported evaluative conclusion that is loosely based upon knowledge and understanding which is applied to the context of the question. Interpretation is basic (AO2). • Very limited analysis and evaluation in the application of knowledge and understanding. This lacks clarity and coherence (AO2). • Very limited and rarely logical evidence of links between knowledge and understanding to the application of knowledge and understanding in different contexts (AO2). • Very limited relevant knowledge and understanding of place(s) and environments (AO1). • Isolated knowledge and understanding of key concepts, processes and interactions and change. There may be a number of inaccuracies. (AO1). • Very limited awareness of scale and temporal change which is rarely integrated where appropriate. There may be a number of inaccuracies (AO1).
Level 0 (0 marks)	• Nothing worthy of credit.

Section B

Question 2 Hot desert systems and landscapes

Qu	Part	Marking guidance	Total marks
02	1	**Outline sources of energy in hot desert environments.** Point marked Allow 1 mark per valid point with extra mark(s) for developed points (d). For example: Notes for answers • The sun is the ultimate source of virtually all energy in surface environments, including hot deserts (1). • Insolation refers to the direct impact of heat from the sun (1). In tropical hot desert regions, the sun's angle of elevation is high so that at some times of the year it is overhead, or nearly so, leading to increased energy concentration and impact upon weathering processes (d). • Wind, as a result of variation of air pressure, is a major source of energy in deserts (1). The greater the pressure gradient, the stronger the wind (d). • Water in the form of flashy storm events is a third major source of energy in deserts (1). Infrequent, unpredictable and intense storm events can lead to high amounts of surface run off and erosion (d). Allow 1 + 1 if appropriately explained and elaborated. • Must offer more than one source for full marks. Allow 1 mark for a list of two or more sources. The notes for answers are not exhaustive. Credit any valid points.	**4** **AO1=4**

02	2	**Analyse the data shown in Figure 3a and Figure 3b.** **AO3** – Responses should use the resource effectively and appropriately showing understanding of the two graphs and the complexity of potential inter-relationships. Expect to see analysis of patterns and identification of potential anomalies. There should be use of data manipulation in support. Mark scheme **Level 2 (4–6 marks)** **AO3** – Clear analysis of the quantitative evidence provided, which makes appropriate use of evidence in support. Clear connection(s) between different aspects of the evidence. **Level 1 (1–3 marks)** **AO3** – Basic analysis of the quantitative evidence provided, which makes limited use of evidence in support. Basic connection(s) between different aspects of the evidence. Notes for answers **AO3** • There are two general statements to reflect the overall pattern. As the stage of desertification increased the level of productivity decreases. Similarly, the percentage of fine sand particles and clay/silt also decreases as stage of desertification increases. • In terms of productivity, the sharpest decreases occur in below ground. For instance, the difference in productivity below ground between lightly desertified areas and moderately desertified areas is around 250 g/m^2 • One anomaly in productivity appears between areas with potential for desertification (PD) and light desertification(LD). LD is more productive that PD with around 60 g/m^2 below ground, 40 g/m^2 above ground and similar amounts of litter. • Whilst clay and silt make up a very small percentage of the soil this is almost eradicated in places experiencing severe desertification. Fine sand particles reduce by around 18–20%. • Some may suggest a correlation between the reduction in clay and silt/ fine sand particles and the reduction in productivity. This is legitimate and clearly potentially related. Credit any other valid analysis.	**6** **AO3=6**

02	3	**Using Figure 4 and your own knowledge, assess the role of weathering in the development of this landscape.** **AO1** – Knowledge and understanding of the factors leading to the formation of formation of inselbergs. **AO2** – Application of knowledge and understanding to understanding of how weathering, the role of wind and differential erosion have	**6** **AO1=2** **AO2=4**

contributed to the development of this landscape.

Mark scheme

Level 2 (4–6 marks)
AO1 – Demonstrates clear knowledge and understanding of concepts, processes, interactions and change.
AO2 – Applies knowledge and understanding to the novel situation offering clear evaluation and analysis drawn appropriately from the context provided. Connections and relationships between different aspects of study are evident with clear relevance.

Level 1 (1–3 marks)
AO1 – Demonstrates basic knowledge and understanding of concepts, processes, interactions and change.
AO2 – Applies limited knowledge and understanding to the novel situation offering only basic evaluation and analysis drawn from the context provided. Connections and relationships between different aspects of study are basic with limited relevance.

Notes for answers
AO1
- Sources of energy in hot desert environments: insolation, winds, runoff.
- Sediment sources, cells and budgets.
- Geomorphological processes: weathering, mass movement, erosion, transportation and deposition.
- The role of wind – erosion: deflation and abrasion; transportation; suspension, saltation, surface creep, deposition.
- Sources of water: exogenous, endoreic and ephemeral; the episodic role of water; sheet flooding.
- Origin and development of landforms of mid and low latitude deserts: inselbergs.

AO2
- Responses should recognise that this is an example of an inselberg. It is a prominent feature within the landscape which stands 348 metres high.
- There should be some recognition that the rock type must be different to that of the surrounding landscape. The more resistant sandstone is likely to have experienced reduced rates of erosion and weathering compared to the surrounding landscape. Differential erosion is likely to have occurred.
- Some may point to the pock marked features on Uluru as evidence of either erosion by wind or weathering processes, but these must have occurred at a reduced rate compared to the surrounding landscape.
- Reference to some of the weathering (thermal fracture, exfoliation, block and granular disintegration) and wind erosion processes (deflation and abrasion) may feature.
- The landscape does not appear to be influenced by the episodic role of water, a feature of other desert landscapes. It therefore likely that most will argue that weathering and wind erosion has gradually broken down and removed the rock in the surrounding landscape leaving this

		large exposed feature. • Some may argue that tectonic uplift may be responsible for the creation of this feature. Generic explanation of the formation of inselbergs (with no attempt to apply knowledge to the image and associated information) should be held to Level 1. Credit any other valid assessment.	

02	4	**'The fragile inter-relationship between climate, soils and vegetation in arid regions is becoming increasingly affected by human activity.'** **How far do you agree with this view?** **AO1** • Knowledge and understanding of the interaction between climate, vegetation and soils in deserts as well as the impact of human activity upon such natural systems. **AO2** • Application of knowledge and understanding to examine the extent to which human activity is affecting these inter-relationships. <u>Notes for answers</u> **AO1** • The global distribution of mid and low latitude deserts and their margins (arid and semi-arid). • Characteristics of hot desert environments and their margins: climate, soils and vegetation (and their interaction). Water balance and aridity index. • The causes of aridity: atmospheric processes relating to pressure, winds, continentality, relief and cold ocean currents. • Predicted climate change and its impacts; alternative possible futures for local populations. • Case study at a local scale of a landscape where desertification has occurred to illustrate and analyse key themes of desertification, causes and impacts, implications for sustainable development. Evaluation of human responses of resilience, mitigation and adaptation. **AO2** • There should be some knowledge and understanding the fragile inter-relationship between climate soils and vegetation. These areas are already some of the least productive on earth with very low rates of plant growth and decomposition. This is caused by the very high temperatures, the large daily range and absence of precipitation. Decomposition rates are low and therefore soil horizons are not well formed. Only highly adapted plant species survive within a very fragile niche. • The changes which human activity may bring are twofold. First encroachment into natural environments as a result of development pressures invariably leads to clearance of any natural vegetation. This is for the purposes of settlement or agriculture. This has more of an impact upon semi-arid areas prone to desertification (e.g. Sahel). Secondly, climate change as a result of human activity is showing evidence of further reducing precipitation levels as well as increasing temperatures. This is also set to cause potentially irreversible damage to both arid and semi-arid areas. • Expect to see reference to the notion that hot deserts are set to	**20** **AO1=10** **AO2=10**

		become even more inhospitable. Also, that deserts are likely to spread into what are currently semi-arid environments. • The question also invites consideration of alternative possible futures. Strategies such as tree planting to reduce soil erosion are likely to feature. Case study support may also support responses e.g. The Green Wall. This should be used in relation to restoring the balance and equilibrium between climate and vegetation and not just in making such areas more productive for humans. Any conclusion is acceptable, though should relate to preceding content.	

Marking grid for Question 2.4

Level/ Mark Range	Criteria/Descriptor
Level 4 (16–20 marks)	• Detailed evaluative conclusion that is rational and firmly based on knowledge and understanding which is applied to the context of the question. Interpretations are comprehensive, sound and coherent (AO2). • Detailed, coherent and relevant analysis and evaluation in the application of knowledge and understanding throughout (AO2). • Full evidence of links between knowledge and understanding to the application of knowledge and understanding in different contexts (AO2). • Detailed, highly relevant and appropriate knowledge and understanding of place(s) and environments used throughout (AO1). • Full and accurate knowledge and understanding of key concepts, processes and interactions and change throughout (AO1). • Detailed awareness of scale and temporal change which is well integrated where appropriate (AO1).
Level 3 (11–15 marks)	• Clear evaluative conclusion that is based on knowledge and understanding which is applied to the context of the question. Interpretations are generally clear and support the response in most aspects (AO2). • Generally clear, coherent and relevant analysis and evaluation in the application of knowledge and understanding (AO2). • Generally clear evidence of links between knowledge and understanding to the application of knowledge and understanding in different contexts (AO2). • Generally clear and relevant knowledge and understanding of place(s) and environments (AO1). • Generally clear and accurate knowledge and understanding of key concepts, processes and interactions and change (AO1). • Generally clear awareness of scale and temporal change which is integrated where appropriate (AO1).
Level 2 (6–10 marks)	• Some sense of an evaluative conclusion partially based upon knowledge and understanding which is applied to the context of the question (AO2). Interpretations are partial but do support the response in places. • Some partially relevant analysis and evaluation in the application of knowledge and understanding (AO2). • Some evidence of links between knowledge and understanding to the application of knowledge and understanding in different contexts (AO2). • Some relevant knowledge and understanding of place(s) and environments which is partially relevant (AO1). • Some knowledge and understanding of key concepts, processes and interactions

	and change. There may be a few inaccuracies (AO1). • Some awareness of scale and temporal change which is sometimes integrated where appropriate. There may be a few inaccuracies (AO1).
Level 1 (1–5 marks)	• Very limited and/or unsupported evaluative conclusion that is loosely based upon knowledge and understanding which is applied to the context of the question. Interpretation is basic (AO2). • Very limited analysis and evaluation in the application of knowledge and understanding. This lacks clarity and coherence (AO2). • Very limited and rarely logical evidence of links between knowledge and understanding to the application of knowledge and understanding in different contexts (AO2). • Very limited relevant knowledge and understanding of place(s) and environments (AO1). • Isolated knowledge and understanding of key concepts, processes and interactions and change. There may be a number of inaccuracies. (AO1). • Very limited awareness of scale and temporal change which is rarely integrated where appropriate. There may be a number of inaccuracies (AO1).
Level 0 (0 marks)	• Nothing worthy of credit.

Question 3 Coastal systems and landscapes

Qu	Part	Marking guidance	Total marks
03	1	**Explain the development of saltmarsh environments**. Point marked Allow 1 mark per valid point with extra mark(s) for developed points (d). For example: Notes for answers • Salt marshes tend to develop in sheltered estuaries behind spits (1). As the spit develops, the area behind it becomes sheltered (d). • Silt is deposited by the river which gradually builds up to form an inter-tidal mud flat (1). The mud flat continues to build and rise above sea level with the addition of further silt (1). • Vegetation which is highly adapted to environment colonises the mud which itself traps further sediment (1). • The salt marsh environment is colonised by halophytic vegetation (1). The Notes for answers are not exhaustive. Credit any valid points.	**4** **AO1=4**
03	2	**Analyse the data shown in Figure 5.** **AO3** – Analysis of the map evidence to identify patterns, anomalies and using data manipulation to support response. Mark scheme **Level 2 (4–6 marks)** **AO3** – Clear analysis of the quantitative evidence provided, which makes appropriate use of evidence in support. Clear connection(s) between different aspects of the evidence. **Level 1 (1–3 marks)** **AO3** – Basic analysis of the quantitative evidence provided, which makes limited use of evidence in support. Basic connection(s) between different aspects of the evidence. Notes for answers **AO3** • There is significant variation in the rates of accretion and erosion of sandy beaches across the world. • Overall, across the continents, beaches are experiencing net gains, most notably in south-east Asia. This area is experiencing accretion rates over 1m/yr greater than any other continent. • Some may argue that in terms of longitudinal analysis, there is some	**6** **AO3=6**

		evidence of mirroring i.e. where rates are high for erosion, there is some evidence that rates are also high for accretion and vice versa. • Some may suggest that this is not the case and point to anomalies such as 30°W or 144°W. At 30°W for example, there is evidence of erosion running at over 50% with accretion at only around 5–10% • In terms of locational patterns there are some distinct bands where erosion is dominant (e.g. India or the band stretching from the Mediterranean to east coast of Africa). There are some bands of significant accretion e.g. south east Asia and northern Canada. • Some may question the usefulness of the resource. There are areas where it is very hard to tell which process is dominant and how much erosion or accretion is taking place e.g. Middle East. Credit any other valid analysis.	

03	3	**Using Figure 6 and your own knowledge, assess the role of vegetation in the development of this landscape.** **AO1** – Knowledge and understanding of the processes related to the development dunes to include vegetation colonisation. **AO2** – Application of this knowledge to the novel situation; specifically, in accounting for the formation of dunes and the role of vegetation in stabilising the dune. <u>Mark scheme</u> **Level 2 (4–6 marks)** **AO1** – Demonstrates clear knowledge and understanding of concepts, processes, interactions and change. **AO2** – Applies knowledge and understanding to the novel situation offering clear evaluation and analysis drawn appropriately from the context provided. Connections and relationships between different aspects of study are evident with clear relevance. **Level 1 (1–3 marks)** **AO1** – Demonstrates basic knowledge and understanding of concepts, processes, interactions, change. **AO2** – Applies limited knowledge and understanding to the novel situation offering only basic evaluation and analysis drawn from the context provided. Connections and relationships between different aspects of study are basic with limited relevance. <u>Notes for answers</u> **AO1** • Origin and development of landforms and landscapes of coastal deposition – sand dunes; factors and processes in their development. • Distinctively coastal processes – transportation: traction, suspension and deposition.	**6** **AO1=2** **AO2=4**

		AO2 • The dunes have developed as a result of onshore winds and the processes of transportation. • Wind blows sand above the high-water mark by the processes of traction and saltation. • As evidenced by Figure 6, this appears to be a well-developed process having occurred over a period of many years. The vegetation is highly adapted to the environment, requiring few nutrients and limited water. Some may reference marram grass as the typical vegetation to first colonise these areas. • The grasses trap blowing sand and help to build up the dune. The dunes in the foreground are smaller and appear to be more recently colonised. The vegetation is more sparsely interspersed and appears to be largely one species. • The root systems bind the sand particles together giving a more rigid structure making the dunes less susceptible to further movement inland. • Some may go further to consider the idea of succession and how the vegetation in the background has much greater coverage and there may be some evidence of species diversity. These more mature dunes are much bigger in size (up to 100 metres above the shoreline). They are well protected by the vegetation which acts to stabilise the dunes. • It is possible to infer that basic soils are likely to be present as a result of succession, hence the increased coverage and biodiversity. Credit any other valid assessment. Generic explanation of the formation of dunes (with no attempt to apply knowledge to the resource and associated information) should be held to Level 1.	

03	4	**'Shoreline management/integrated coastal zone management can effectively tackle the expected eustatic sea level change and associated threat to coastal landscapes over the coming decades.'** **To what extent do you agree with this view?** **AO1** – Knowledge and understanding of integrated shoreline management plans and their role in mitigating the impact of sea level change. **AO2** – Application of knowledge and understanding to evaluate the role of shoreline management plans in managing changing coastal landscapes. <u>Notes for answers</u> **AO1** • Recent and predicted climatic change and potential impact on coasts. • The relationship between process, time, landforms and landscapes in	**20** **AO1=10** **AO2=10**

		coastal settings. • Human intervention in coastal landscapes. Traditional approaches to coastal flood and erosion risk: hard and soft engineering. Sustainable approaches to coastal flood risk and coastal erosion management: shoreline management/integrated coastal zone management. • Case study(ies) of coastal environment(s) at a local scale to illustrate and analyse fundamental coastal processes, their landscape outcomes as set out above and engage with field data and challenges represented in their sustainable management. • Case study of a contrasting coastal landscape beyond the UK to illustrate and analyse how it presents risks and opportunities for human occupation and development and evaluate human responses of resilience, mitigation and adaptation. **AO2** • Expect to see some definition of the concept of the integrated shoreline management plan (ISMP). The basic idea is that shoreline management should be considered in terms of managing the processes operating within distinct sediment cells. This is a relatively new way of thinking about coastal management (last 30 years or so) as it does not take into account the artificial boundaries established to maintain the administrative responsibilities of Local Authorities. This latter approach was deemed to be unsystematic producing shoreline management strategies which were sometimes conflicting and certainly not taking into consideration the knock-on effects of decision making in one place. • The plans were introduced in 1995 with short, medium and long term elements to each strategy. Many of the short term plans were designed to last up to 20 years and have been continually reviewed updated and modified. • The key purpose of the plans has been to provide local authorities with research and analysis to help manage risks related to sea level change, erosion and flooding. There is also an element of sustainability attached to plans in that the primary purpose of any recommendations is to protect the coastline in a long term and sustainable fashion. This takes into account maintenance of the physical environment, protection for people, environmental sustainability and habitat protection. • In terms of evaluation, ISMPs have delivered a much more coherent and sustainable approach to coastal management than was previously the case by providing research and analysis related to risk in each location. The second round of ISMPs has now been established across the country with decision making based upon the best fit approach within each sediment cell. • Options are hold the line, advance the line, do nothing and managed retreat. • Expect to see case studies used to exemplify different aspects of shoreline management plans and specifically how these plans are/were designed to tackle erosion, flooding and or mitigate the risks associated with rising sea levels. • In assessing the effectiveness of ISMPs as a tool to mitigate sea level rise, there should be some understanding that cost is huge and a	

		decisive factor in decision making. Tough decisions have to be made and not every area of the country can be protected to the satisfaction of local interests. • Case studies involving successes and perceived failures of ISMPs may feature e.g. Happisburgh. Credit any other valid approach. Evaluation should be based upon preceding content.	

Marking grid for Question 3

Level/ Mark Range	Criteria/Descriptor
Level 4 (16–20 marks)	• Detailed evaluative conclusion that is rational and firmly based on knowledge and understanding which is applied to the context of the question. Interpretations are comprehensive, sound and coherent (AO2). • Detailed, coherent and relevant analysis and evaluation in the application of knowledge and understanding throughout (AO2). • Full evidence of links between knowledge and understanding to the application of knowledge and understanding in different contexts (AO2). • Detailed, highly relevant and appropriate knowledge and understanding of place(s) and environments used throughout (AO1). • Full and accurate knowledge and understanding of key concepts, processes and interactions and change throughout (AO1). • Detailed awareness of scale and temporal change which is well integrated where appropriate (AO1).
Level 3 (11–15 marks)	• Clear evaluative conclusion that is based on knowledge and understanding which is applied to the context of the question. Interpretations are generally clear and support the response in most aspects (AO2). • Generally clear, coherent and relevant analysis and evaluation in the application of knowledge and understanding (AO2). • Generally clear evidence of links between knowledge and understanding to the application of knowledge and understanding in different contexts (AO2). • Generally clear and relevant knowledge and understanding of place(s) and environments (AO1). • Generally clear and accurate knowledge and understanding of key concepts, processes and interactions and change (AO1). • Generally clear awareness of scale and temporal change which is integrated where appropriate (AO1).
Level 2 (6–10 marks)	• Some sense of an evaluative conclusion partially based upon knowledge and understanding which is applied to the context of the question (AO2). Interpretations are partial but do support the response in places. • Some partially relevant analysis and evaluation in the application of knowledge and understanding (AO2). • Some evidence of links between knowledge and understanding to the application of knowledge and understanding in different contexts (AO2). • Some relevant knowledge and understanding of place(s) and environments which is partially relevant (AO1). • Some knowledge and understanding of key concepts, processes and interactions and change. There may be a few inaccuracies (AO1). • Some awareness of scale and temporal change which is sometimes integrated where appropriate. There may be a few inaccuracies (AO1).

Level 1 (1–5 marks)	• Very limited and/or unsupported evaluative conclusion that is loosely based upon knowledge and understanding which is applied to the context of the question. Interpretation is basic (AO2). • Very limited analysis and evaluation in the application of knowledge and understanding. This lacks clarity and coherence (AO2). • Very limited and rarely logical evidence of links between knowledge and understanding to the application of knowledge and understanding in different contexts (AO2). • Very limited relevant knowledge and understanding of place(s) and environments (AO1). • Isolated knowledge and understanding of key concepts, processes and interactions and change. There may be a number of inaccuracies. (AO1). • Very limited awareness of scale and temporal change which is rarely integrated where appropriate. There may be a number of inaccuracies (AO1).
Level 0 (0 marks)	• Nothing worthy of credit.

Question 4 Glacial systems and landscapes

Qu	Part	Marking guidance	Total marks
04	1	**Explain the formation of rôches moutonnées.** Point marked Allow 1 mark per valid point with extra mark(s) for developed points (d). For example: Point marked **AO1** • Rôches moutonnées are erosional landforms found in previously glaciated valleys (1). • More resistant protrusions of rock are eroded smoothed and shaped by an advancing glacier (1). • The rôches moutonnées is smoothed and eroded in the direction that the glacier that once passed over it (1). This is referred to as the stoss side(d). • It is often marked with glacial striations which are aligned to the direction of ice travel (1). • The rough and craggy down-ice (leeward) side is formed by plucking or quarrying (1). This erosional process is initiated when ice melts slightly by pressure and seeps into cracks in the rock (d). When the water refreezes, the rock becomes attached to the glacier. But as the glacier continues its forward progress it subjects the stone to frost shattering, ripping pieces away from the rock formation (d). The Notes for answers are not exhaustive. Credit any valid points.	**4** **AO1=4**
04	2	**Analyse the data shown in Figure 7a, Figure 7b and Figure 7c.** **AO3** – Responses should use the resource effectively and appropriately showing understanding of the graph and map. There should be an understanding of complexity of the inter-relationships. Expect to see analysis of patterns and identification of potential anomalies. There should be use of data in support. Mark scheme **Level 2 (4–6 marks)** **AO3** – Clear analysis and interpretation of the quantitative evidence provided, which makes appropriate use of data in support. Clear connection(s) between different aspects of the data and evidence. **Level 1 (1–3 marks)** **AO3** – Basic analysis and interpretation of the quantitative evidence provided, which makes limited use of data and evidence in support. Basic connection(s) between different aspects of the data and evidence.	**6** **AO3=6**

		Notes for answers **AO3** • The ice sheet is experiencing melting across all of the peripheral areas as shown in **Figure 7a**. The number of melt days is at its highest on the west coast with several areas experiencing over 100 days of net melting. This is especially the case in a north south aligned region in the southwest of Greenland. • The evidence is further corroborated by the data show in **Figure 7b**. There is clear evidence that the number of melt days is increasing, particularly on the west coast. However, on the south-east coast, there does appear to evidence that the number of melt days is less than average by up to 15–25 days. • Some may note that much of the interior experiences no net melting. • In terms of the percentage area affected by melting in 2017, there is substantial variation from the 1981–2010 median (**Figure 7c**). In late July for example there is up to 23% increase in area melted compared to the median. Some may note that the 2017 data shows substantial fluctuation compared to the median. Credit any other valid analysis.	

04	3	**Using Figure 8 and your own knowledge, assess the role of frost action in the development of this landscape.** **AO1** – Knowledge and understanding of periglacial landscape development. **AO2** – Applies knowledge and understanding to the context of the question in accounting for the development of this landscape. Mark scheme **Level 2 (4–6 marks)** **AO1** – Demonstrates clear knowledge and understanding of concepts, processes, interactions and change. **AO2** – Applies knowledge and understanding to this novel situation offering clear evaluation and analysis drawn appropriately from the context provided. Connections and relationships between different aspects of study are evident with clear relevance. **Level 1 (1–3 marks)** **AO1** – Demonstrates basic knowledge and understanding of concepts, processes, interactions and change. **AO2** – Applies limited knowledge and understanding to the novel situation offering only basic evaluation and analysis drawn from the context provided. Connections and relationships between different aspects of study are basic with limited relevance.	**6** **AO1=2** **AO2=4**

		Notes for answers **AO1** • Periglacial features and processes: permafrost, active layer and mass movement. • Periglacial landforms: patterned ground, ice wedges, pingos, thermokarst. Characteristic periglacial landscapes and associated geomorphological processes. **AO2** • There is clear evidence that this is a periglacial landscape. This is provided by the ice wedge polygons and the pingo in the centre of the image. • The image appears to have been taken in summer as much of the landscape is covered by standing water (with perhaps some snow or ice to the top left). • It is not clear if the image contains stone polygons or ice wedge polygons (and possibly a combination of both). • At low temperatures cracks emerge in the bedrock which are filled with water in summer. Repeated freezing and thawing causes the wedges to widen; ridges develop through the process of frost heave. In summer the cracks are filled with water as shown in the image. • There are different theories to account for the formation of the pingo. Alternative theories are permissible. In this case the feature is well developed and appears to be vegetated and covered with more ice wedges. Some may argue that a frozen ice lens sits beneath the ground and has forced up the pingo to create its prominent shape on the landscape. Credit any other valid assessment. Generic explanation of the development of periglacial landscapes (with no attempt to apply knowledge to the image) should be held to Level 1.	

04	4	**With reference to a glaciated landscape from beyond the UK, assess the impact of human activity upon the natural systems and physical landscape.** **AO1** – Knowledge and understanding of process and landforms in glaciated environments. Knowledge and understanding of the range of human activities and their impact upon these landscapes. **AO2** – Applies knowledge and understanding to the context of the question in assessing the impact of human activity upon natural systems and the physical landscape. Notes for answers **AO1** • Glacial systems including glacial budgets.	20 **AO1=10** **AO2=10**

		• Ablation and accumulation – historical patterns of ice advance and retreat. • Fluvioglacial processes: meltwater, erosion transportation and deposition. • Periglacial features and processes: permafrost, active layer and mass movement. • Origin and development of glaciated landscapes. • Characteristic glaciated landscapes. • The relationship between process, time, landforms and landscapes in glaciated settings: characteristic glaciated and periglacial landscapes. • Concept of environmental fragility. Human impacts on fragile cold environments over time and at a variety of scales. Recent and prospective impact of climate change. Management of cold environments at present and in alternative possible futures. • Case study of a contrasting glaciated landscape from beyond the UK to illustrate and analyse how it presents challenges and opportunities for human occupation and development and evaluate human responses of resilience, mitigation and adaptation. **AO2** • The thrust of the response will largely depend upon the chosen glaciated environment. Expect to see reference to The Alps, Svalbard (Norway) and the Athabasca Glacier (USA). • Most are likely to take a negative view in their assessment ie that human activity is having a detrimental impact on both the physical landscape and the natural systems. However, there are opportunities to consider conservation and general measures being to protect these environments. • Svalbard is a glaciated Norwegian archipelago. Human activities here are generally related to fishing, coal mining, and tourism. There are also around 3000 people living in Svalbard. • Coal mining has a detrimental impact upon the local environment. The industry is outdated and pollution is a significant issue. There is substantial pressure to provide alternative sources of energy for the people of the island. • Fishing is generally considered to be sustainable. This is closely monitored by the Norwegian government and the Russians. Overfishing and pollution are some of the threats to the natural systems. • Research stations provide invaluable data on climate change. In this sense some might argue that Svalbard is providing some of the best evidence for climate change and therefore support for actions to reduce greenhouse gas emissions. • Tourism is also largely sustainable. Around 70 000 tourist visits each year but much of this is to explore the seas and wildlife around the islands. • Settlement development – Longyearbyen is home to around 3000 people. There are challenges in living in such an inhospitable environment but as numbers are so low, environmental disturbance	

		has been kept to a minimum. • Some will argue that climate change is the biggest threat to places such as Svalbard. Warming will reduce ice cover and affect the sea temperature around the islands. This may have a very negative consequence for the ecosystems on both land and at sea. This is a legitimate argument. There should be some explicit assessment in the context of the question. Credit any other valid assessment.	

Marking grid for Question 4.4

Level/ Mark Range	Criteria/Descriptor
Level 4 (16–20 marks)	• Detailed evaluative conclusion that is rational and firmly based on knowledge and understanding which is applied to the context of the question (AO2). • Detailed, coherent and relevant analysis and evaluation in the application of knowledge and understanding throughout (AO2). • Full evidence of links between knowledge and understanding to the application of knowledge and understanding in different contexts (AO2). • Detailed, highly relevant and appropriate knowledge and understanding of place(s) and environments used throughout (AO1). • Full and accurate knowledge and understanding of key concepts and processes throughout (AO1). • Detailed awareness of scale and temporal change which is well integrated where appropriate (AO1).
Level 3 (11–15 marks)	• Clear evaluative conclusion that is based on knowledge and understanding which is applied to the context of the question (AO2). • Generally clear, coherent and relevant analysis and evaluation in the application of knowledge and understanding (AO2). • Generally clear evidence of links between knowledge and understanding to the application of knowledge and understanding in different contexts (AO2). • Generally clear and relevant knowledge and understanding of place(s) and environments (AO1). • Generally clear and accurate knowledge and understanding of key concepts and processes (AO1). • Generally clear awareness of scale and temporal change which is integrated where appropriate (AO1).
Level 2 (6–10 marks)	• Some sense of an evaluative conclusion partially based upon knowledge and understanding which is applied to the context of the question (AO2). • Some partially relevant analysis and evaluation in the application of knowledge and understanding (AO2). • Some evidence of links between knowledge and understanding to the application of knowledge and understanding in different contexts (AO2). • Some relevant knowledge and understanding of place(s) and environments which is partially relevant (AO1). • Some knowledge and understanding of key concepts, processes and interactions and change (AO1). • Some awareness of scale and temporal change which is sometimes integrated where appropriate. There may be a few inaccuracies (AO1).

Level 1 (1–5 marks)	• Very limited and/or unsupported evaluative conclusion that is loosely based upon knowledge and understanding which is applied to the context of the question (AO2). • Very limited analysis and evaluation in the application of knowledge and understanding. This lacks clarity and coherence (AO2). • Very limited and rarely logical evidence of links between knowledge and understanding to the application of knowledge and understanding in different contexts (AO2). • Very limited relevant knowledge and understanding of place(s) and environments (AO1). • Isolated knowledge and understanding of key concepts and processes (AO1). • Very limited awareness of scale and temporal change which is rarely integrated where appropriate. There may be a number of inaccuracies (AO1).
Level 0 (0 marks)	• Nothing worthy of credit.

Section C

Question 5 Hazards

Qu	Part	Marking guidance	Total marks
05	1	**What is an appropriate measure to tackle the spread of wildfire?** D	**1** **AO1=1**
05	2	**What is an island arc?** A	**1** **AO1=1**
05	3	**What is the process of slab pull?** C	**1** **AO1=1**
05	4	**Which is the method for measuring the size of a volcanic eruption?** D	**1** **AO1=1**
05	5	**Using Figure 9a and Figure 9b, analyse the data shown** **AO3** – There are two resources to use in conjunction with each other. The skills relate to map and satellite data analysis. <u>Mark scheme</u> **Level 2 (4–6 marks)** **AO3** – Clear analysis of a geographical issue or question. Clear interpretation of the quantitative evidence provided, which makes appropriate use of data in support. Clear connection(s) between different aspects of the data and evidence. **Level 1 (1–3 marks)** **AO3** – Basic analysis of a geographical issue or question. Basic interpretation of the quantitative and qualitative evidence provided, which makes limited use of data and evidence in support. Basic connection(s) between different aspects of the data and evidence. <u>Notes for answers</u> **AO3** • This area has experienced a significant amount of volcanic activity in	**6** **AO3=6**

		recent years. The flows appear to be emanating along a rift zone which is aligned from south west to north east and close to the summit of the Kilauea volcano. All of the flows appear to then move in a south easterly direction towards the coast. The only exception is an area to the south east of the Leilani Estates. Here the lava appears to follow a path of steepest descent. The flows also, at least in part, follow flow channels towards the coastline south west of Pohoiki. • Figure 9b shows a plume of what appears to be volcanic ash, gas and dust. The direction of travel is south westerly and the plume appears to lose height with distance from site of eruption. From around 3 km the plume drops in height by around 2.25 km just south of Ocean View Station. This is approximately 70 to 100 km from the eruption site. One anomaly appears to be that the plume of gas, ash and dust appears to rise again by around 1 km to 1.5 km. Credit any other valid analysis.	

05	6	**Using Figure 10 and your own knowledge, assess the potential issues associated with managing an event such as this.** **AO1** – Knowledge and understanding of cause, impact and management of wildfire. **AO2** – Application of knowledge and understanding to assess the scale of challenge associated with managing an event such as this in such a relatively inaccessible location. <u>Mark scheme</u> **Level 3 (7–9 marks)** **AO1** – Demonstrates detailed knowledge and understanding of concepts, processes, interactions and change. These underpin the response throughout. **AO2** – Applies knowledge and understanding appropriately with detail. Connections and relationships between different aspects of study are fully developed with complete relevance. Evaluation is detailed and well supported with appropriate evidence. **Level 2 (4–6 marks)** **AO1** – Demonstrates clear knowledge and understanding of concepts, processes, interactions and change. These are mostly relevant though there may be some minor inaccuracy. **AO2** – Applies clear knowledge and understanding appropriately. Connections and relationships between different aspects of study are evident with some relevance. Evaluation is evident and supported with clear and appropriate evidence. **Level 1 (1–3 marks)** **AO1** – Demonstrates basic knowledge and understanding of concepts, processes, interactions and change. This offers limited relevance with inaccuracy.	**9** **AO1=4** **AO2=5**

		AO2 – Applies limited knowledge and understanding. Connections and relationships between different aspects of study are basic with limited relevance. Evaluation is basic and supported with limited appropriate evidence. <u>Notes for answers</u> **AO1** • Nature of wildfires. Conditions favouring intense wild fires: vegetation type, fuel characteristics, climate and recent weather and fire behaviour. • Causes of fires: natural and human agency. Impacts: primary/ secondary, environmental, social, economic, political. • Short and long-term responses; risk management designed to reduce the impacts of the hazard through preparedness, mitigation, prevention and adaptation. • Impact and human responses as evidenced by a recent wild fire event. **AO2** • The first issue is scale. The area affected is clearly extensive with multiple sources of fire. This requires substantial support from expert firefighters. • Accessibility is another issue. These are upland areas. Getting large and cumbersome equipment up to such relatively remote locations is likely to be extremely challenging. • The weather appears to be presenting another major issue. The lack of rainfall, prolonged heat and very dry conditions means that new fires are likely to start. • Some may recognise that peat is a flammable material. The fact that the underlying soil is composed of peat means that the fire can spread underground making it almost impossible to manage without extensive rainfall. • Evacuation is another issue. In this case the smoke is blowing towards the north of Stalybridge. This will present a major health and safety issue for the local managers. Evacuation may be required particularly for the elderly or infirm. • Communication is another significant challenge for the local managers. Emergency planners will need a communication strategy for local people which remains up-to-date and responsive to the changing dynamic. • Transport issues are likely to emerge particularly where the smoke causes poor visibility or where the fire is close to roads. Any planning is likely to require road closures and re-routing of vehicles. • The apparent deliberate starting of the fire is a major concern. Managing the fire itself is a problem but other arsonists may copy the original offender exacerbating the issue for the local emergency services. Credit any other valid assessment.	

05	7	**To what extent do you agree that the impact of volcanic activity can be mitigated against more effectively than tropical storms?** **AO1** – Knowledge and understanding of the responses to tropical storm hazards. Knowledge and understanding of the responses to volcanic hazards. **AO2** – Application of knowledge and understanding in evaluating the relative ease with which these events can be managed. <u>Mark scheme</u> **Level 3 (7–9 marks)** **AO1** – Demonstrates detailed knowledge and understanding of concepts, processes, interactions and change. These underpin the response throughout. **AO2** – Applies knowledge and understanding appropriately with detail. Connections and relationships between different aspects of study are fully developed with complete relevance. Evaluation is detailed and well supported with appropriate evidence. **Level 2 (4–6 marks)** **AO1** – Demonstrates clear knowledge and understanding of concepts, processes, interactions and change. These are mostly relevant though there may be some minor inaccuracy. **AO2** – Applies clear knowledge and understanding appropriately. Connections and relationships between different aspects of study are evident with some relevance. Evaluation is evident and supported with clear and appropriate evidence. **Level 1 (1–3 marks)** **AO1** – Demonstrates basic knowledge and understanding of concepts, processes, interactions and change. This offers limited relevance with inaccuracy. **AO2** – Applies limited knowledge and understanding. Connections and relationships between different aspects of study are basic with limited relevance. Evaluation is basic and supported with limited appropriate evidence. <u>Notes for answers</u> **AO1** • The nature of tropical storms and their underlying causes. Forms of storm hazard: high winds, storm surges, coastal flooding, river flooding and landslides. Spatial distribution, magnitude, frequency, regularity, predictability of hazard events. • Impacts: primary/secondary, environmental, social, economic, political. Short and long-term responses: • risk management designed to reduce the impacts of the hazard through preparedness, mitigation, prevention and adaptation. • Impacts and human responses as evidenced by two recent tropical storms in contrasting areas of the world. • The nature of vulcanicity and its relation to plate tectonics: forms of volcanic hazard: nuées ardentes, lava flows, mudflows, pyroclastic and	**9** **AO1=4** **AO2=5**

		ash fallout, gases/acid rain, tephra. Spatial distribution, magnitude, frequency, regularity and predictability of hazard events. • Impacts: primary/secondary, environmental, social, economic, political. Short and long-term responses: • risk management designed to reduce the impacts of the hazard through preparedness, mitigation, prevention and adaptation. • Impacts and human responses as evidenced by a recent volcanic event. **AO2** • Candidate responses are likely to be heavily influenced by the exemplification and case study material. Clearly the answer to the question depends upon the event. • Cyclone Nargis for example killed 138 000 in 2008. This caused the worst natural disaster in the recorded history of Myanmar. • The cyclone made landfall in Myanmar on Friday, 2 May 2008, sending a storm surge 40 kilometres up the densely populated Irrawaddy delta, causing catastrophic destruction. The Labutta Township alone was reported to have 80 000 dead, with about 10 000 more deaths in Bogale. Damage was estimated at over US$10 billion. • Clearly managing this event, for the government of Myanmar was impossible. The scale of the devastation and the lack of preparedness and evacuation strategies meant that local people simply did not have a chance. There was an international aid effort following the event and this no doubt helped to minimise the secondary impacts. • Similarly the Armero tragedy of 1985 led to 23 000 deaths when an eruption triggered a series of lahars. The location and relative poverty meant that local people did not have a chance to escape the 50 kmph lahars. • Some may argue that tropical storms are more predictable and with latest forecasting and satellite technology, it is possible to avoid the worst impacts by evacuation. However equally, in recent history, tropical storms (and their impacts) have proved to be far more deadly than volcanic eruptions. Either position is acceptable as long as it is coherently argued.	

05	8	**Assess the relative usefulness of the Park Model and the Hazard Management Cycle in understanding the impact of seismic events.** **AO1** – Knowledge and understanding of models associated with managing natural disasters. **AO2** – Application of knowledge and understanding to assess the usefulness of the models in understanding the impact of seismic events. <u>Notes for answers</u> **AO1** • Nature, forms and potential impacts of natural hazards (geophysical, atmospheric and hydrological). • Hazard perception and its economic and cultural determinants.	**20** **AO1=10** **AO2=10**

		• Characteristic human responses – fatalism, prediction, adjustment/adaptation, mitigation, management, risk sharing – and their relationship to hazard incidence, intensity, magnitude, distribution and level of development. • The Park model of human response to hazards. • The Hazard Management Cycle. • The nature of seismicity and its relation to plate tectonics: forms of seismic hazard: earthquakes, shockwaves, tsunamis, liquefaction, landslides. Spatial distribution, randomness, magnitude, frequency, regularity, predictability of hazard events. • Impacts: primary/secondary; environmental, social, economic, political. Short and long-term responses; risk management designed to reduce the impacts of the hazard through preparedness, mitigation, prevention and adaptation. • Impacts and human responses as evidenced by a recent seismic event. **AO2** • The Park Model is arguably more useful in that it charts the stages following a natural disaster. The curve charts the changes to a community's quality of life, before during and after a natural disaster. • Normality is experienced before the event. The downward curve charts the decline (or disruption) which the affected community feels following the event. The steeper the curve and the deeper the drop, the greater the magnitude of the event and the greater the lack of preparedness. The return to normality or recovery to a better quality of life is also charted in Park's Model. This is useful in helping to understand how prepared a community was for the event and how successful it has been in responding to the crisis. The longer it takes to recover normality, the greater the suffering on the people. • Expect to see exemplification such as the Haiti earthquake of 2010. The country was totally unprepared. It had neither the means nor the communication strategy to manage the event. Poor building design exacerbated the tragedy. Estimates of up to 230 000 deaths may be conservative and fail to identify the secondary impacts. • The model arguably falls short in helping to understand the situation in Haiti. When Hurricane Matthew struck in 2016, this plunged the community into yet another crisis when it had not yet recovered from the seismic event. It is difficult to see how the model can help with understanding this very complex event. • The hazard management cycle is more concerned with the management of natural event before and after its inception. Whilst it does help in understanding the impact of the event, this is more implicit. Its primary purpose is to provide a model of action both prior to and after the event. The actions are designed to speed up the recovery process as well as minimise the impact. • Both models chart the movement of a community through a natural disaster. However, expect most to argue to that the Park Model, despite some limitations, is more useful in helping to understand seismic events compared to the hazard management cycle. Credit any other valid assessment.	

Marking grid for Question 5.8

Level/ Mark Range	Criteria/Descriptor
Level 4 (16–20 marks)	• Detailed evaluative conclusion that is rational and firmly based on knowledge and understanding which is applied to the context of the question. Interpretations are comprehensive, sound and coherent (AO2). • Detailed, coherent and relevant analysis and evaluation in the application of knowledge and understanding throughout (AO2). • Full evidence of links between knowledge and understanding to the application of knowledge and understanding in different contexts (AO2). • Detailed, highly relevant and appropriate knowledge and understanding of place(s) and environments used throughout (AO1). • Full and accurate knowledge and understanding of key concepts, processes and interactions and change throughout (AO1). • Detailed awareness of scale and temporal change which is well integrated where appropriate (AO1).
Level 3 (11–15 marks)	• Clear evaluative conclusion that is based on knowledge and understanding which is applied to the context of the question (AO2). • Generally clear, coherent and relevant analysis and evaluation in the application of knowledge and understanding (AO2). • Generally clear evidence of links between knowledge and understanding to the application of knowledge and understanding in different contexts (AO2). • Generally clear and relevant knowledge and understanding of place(s) and environments (AO1). • Generally clear and accurate knowledge and understanding of key concepts and processes (AO1). • Generally clear awareness of scale and temporal change which is integrated where appropriate (AO1).
Level 2 (6–10 marks)	• Some sense of an evaluative conclusion partially based upon knowledge and understanding which is applied to the context of the question (AO2). • Some partially relevant analysis and evaluation in the application of knowledge and understanding (AO2). • Some evidence of links between knowledge and understanding to the application of knowledge and understanding in different contexts (AO2). • Some relevant knowledge and understanding of place(s) and environments which is partially relevant (AO1). • Some knowledge and understanding of key concepts, processes and interactions and change (AO1). • Some awareness of scale and temporal change which is sometimes integrated where appropriate. There may be a few inaccuracies (AO1).
Level 1 (1–5 marks)	• Very limited and/or unsupported evaluative conclusion that is loosely based upon knowledge and understanding which is applied to the context of the question (AO2). • Very limited analysis and evaluation in the application of knowledge and understanding. This lacks clarity and coherence (AO2). • Very limited and rarely logical evidence of links between knowledge and understanding to the application of knowledge and understanding in different contexts (AO2). • Very limited relevant knowledge and understanding of place(s) and environments (AO1). • Isolated knowledge and understanding of key concepts and processes (AO1). • Very limited awareness of scale and temporal change which is rarely integrated where appropriate. There may be a number of inaccuracies (AO1).
Level 0 (0 marks)	• Nothing worthy of credit.

Question 6 Ecosystems under stress

Qu	Part	Marking guidance	Total marks
06	1	**What is a seral stage?** C	**1** **AO1=1**
06	2	**What is the distinction between the biotic and abiotic components of an ecosystem?** D	**1** **AO1=1**
06	3	**What are trophic levels?** A	**1** **AO1=1**
06	4	**Why is weathering important in nutrient cycling?** D	**1** **AO1=1**
06	5	**Analyse the data shown in Figure 11a and Figure 11b.** **AO3** – There are two resources to use in conjunction with each other. The skills relate to graphical interpretation. Analysis relates to identification of pattern and trends as well as anomaly. Where appropriate there should be some manipulation of data. <u>Mark scheme</u> **Level 2 (4–6 marks)** **AO3** – Clear analysis of the quantitative evidence provided, which makes appropriate use of data in support. Clear connection(s) between different aspects of the data and evidence. **Level 1 (1–3 marks)** **AO3** – Basic analysis of the quantitative evidence provided, which makes limited use of data and evidence in support. Basic connection(s) between different aspects of the data and evidence. <u>Notes for answers</u> **AO3** • Rainfall shows some variability over the period. There are some common repeating patterns. For example, October to April in each year appears to be the wet season with relatively little rainfall from April/May to October. Most daily rainfall totals are around 10–40mm though there are some extreme anomalies. For example, in December 2010 rainfall totals were over 120 mm/day. Cumulative totals also appear to be declining over the period. The total for 2011 is around 400 mm less than for 2009.	**6** **AO3=6**

		• There is an inverse relationship between soil water content and albedo. When soil moisture content is high, albedo is low and vice versa. Soil moisture content also mirrors daily rainfall fairly closely. The highest albedo scores correlate fairly closely with the periods of lowest rainfall. For instance in August/September 2010, albedo PAR was over 0.05, soil moisture was 100 mm (almost 300 mm lower than the maximum) and rainfall was practically zero. Credit any other valid analysis.	

06	6	**Using Figure 12a, Figure 12b and your own knowledge, assess the potential role of human activity as an arresting factor shaping this landscape.** **AO1** – Knowledge and understanding of the concept of plagioclimax. Awareness of management of heather moorland. **AO2** – Application of knowledge and understanding to assess the role of human activity in shaping heather moorland. <u>Mark scheme</u> **Level 3 (7–9 marks)** **AO1** – Demonstrates detailed knowledge and understanding of concepts, processes, interactions and change. These underpin the response throughout. **AO2** – Applies knowledge and understanding appropriately with detail. Connections and relationships between different aspects of study are fully developed with complete relevance. Analysis is detailed and well supported with appropriate evidence. **Level 2 (4–6 marks)** **AO1** – Demonstrates clear knowledge and understanding of concepts, processes, interactions and change. These are mostly relevant though there may be some minor inaccuracy. **AO2** – Applies clear knowledge and understanding appropriately. Connections and relationships between different aspects of study are evident with some relevance. Analysis is evident and supported with clear and appropriate evidence. **Level 1 (1–3 marks)** **AO1** – Demonstrates basic knowledge and understanding of concepts, processes, interactions and change. This offers limited relevance with inaccuracy. **AO2** – Applies limited knowledge and understanding. Connections and relationships between different aspects of study are basic with limited relevance. Analysis is basic and supported with limited appropriate evidence.	**9** **AO1=4** **AO2=5**

		Notes for answers **AO1** • Concepts of succession: seral stages, climatic climax, sub-climax and plagioclimax. • Nature of terrestrial ecosystems and the inter-connections between climate, vegetation, soil and topography which produce them. Ecosystem responses to changes in one or more of their components or environmental controls. • Factors influencing the changing of ecosystems, including climate change and human exploitation of the environment. • The effects of human activity on succession – illustrated by one plagioclimax such as a heather moorland. **AO2** • Candidates may identify that this is heather moorland. It is an example of a plagioclimax. • If the area was left untouched, natural processes of succession would take over. Given time for soils to recover, trees would start to dominate the landscape and these would outcompete the heather for light. The heather would die off and be taken over by trees as the area becomes a deciduous woodland. • Human activity has been an arresting factor for many hundreds if not thousands of years in this landscape. Forests were cleared to make grazing land for sheep. This exposed the soils to rainsplash impact and erosion. Smaller hardy shrubs and grasses then colonised the area. • More recently the heather is managed for the sport of grouse shooting. • It is achieved by controlled burning of the heather. This ensures that the current equilibrium is maintained. • Human activity is therefore essential in maintaining the plagioclimax. Without this management a secondary succession would occur and eventually the area would return to its original state. • Whilst most will study heather moorland, it is not required in the specification. Responses may therefore apply knowledge using a different plagioclimax. Credit any other valid assessment.	

06	7	**Evaluate the impact of human activity upon the future prospects for coral reefs.** **AO1** –Knowledge and understanding of the factors affecting the health and survival of coral. **AO2** – Application of knowledge and understanding to evaluate the potential role of human activity in securing the long-term future, health and survival of coral reefs. <u>Mark scheme</u> **Level 3 (7–9 marks)** **AO1** – Demonstrates detailed knowledge and understanding of concepts, processes, interactions and change. These underpin the response throughout. **AO2** – Applies knowledge and understanding appropriately with detail. Connections and relationships between different aspects of study are fully developed with complete relevance. Evaluation is detailed and well supported with appropriate evidence. **Level 2 (4–6 marks)** **AO1** – Demonstrates clear knowledge and understanding of concepts, processes, interactions and change. These are mostly relevant though there may be some minor inaccuracy. **AO2** – Applies clear knowledge and understanding appropriately. Connections and relationships between different aspects of study are evident with some relevance. Evaluation is evident and supported with clear and appropriate evidence. **Level 1 (1–3 marks)** **AO1** – Demonstrates basic knowledge and understanding of concepts, processes, interactions and change. This offers limited relevance with inaccuracy. **AO2** – Applies limited knowledge and understanding. Connections and relationships between different aspects of study are basic with limited relevance. Evaluation is basic and supported with limited appropriate evidence. <u>Notes for answers</u> **AO1** • Factors in the health and survival of reefs: Natural: Water temperature, acidity, salinity, algal blooms. • Human activity and its impact: Major drainage basin schemes, onshore development, desalination, pollution, tourism, fishing. • Future prospects for coral reefs. **AO2** • The main threat facing coral are: bleaching caused by the expulsion of algae following stress from temperature change or change in nutrient levels; pollution of local water systems by industry and services such as tourism; highly damaging activities such as dynamite fishing. • The long-term health and survival of coral is intrinsically linked to	**9** **AO1=4** **AO2=5**

		human activity. There are a variety of activities which have taken place in recent years which pose direct threats to coral. These include dynamite fishing, overfishing, pollution of aquatic environments and overly intrusive tourism activities. Equally there is a growing momentum around protection and conservation of the great natural environments. • This question invites candidates to consider the future of coral in positive or negative terms. Either approach is valid and should be based upon preceding content. • Local measures taken in order to control the worst impacts of fishing and the impacts of tourism are likely to feature in more positive responses. • Some may consider a regional or even global perspective around reducing pollution and curbing the impact of climate change – both key threats to the future of coral. • Some may refer to local initiatives targeted at reducing the impact of human activity and restoring the balance between coral and its natural environment. • Many are likely to conclude that, without sustained, coordinated and consistent action, the current trajectory and therefore future prospects for coral are bleak. Credit any other valid approach. Evaluation should be based upon preceding content.	

06	8	**'Changing attitudes towards sustainable tourism, recreation and conservation have meant that local scale ecosystems are no longer under threat.'** **To what extent do you agree with this view?** **AO1** – Knowledge and understanding of factors affecting small scale ecosystems. **AO2** – Application of knowledge and understanding to evaluate the extent to which small scale ecosystems are managed sustainably. <u>Notes for answers</u> **AO1** • Ecosystems and their importance for human populations in the light of continuing population growth and economic development. Human populations in ecosystem development and sustainability. • The main characteristics of a distinctive local ecosystem (such as an area of heathland, managed parkland, pond, dune system). Ecological responses to the climate, soil and soil moisture budget – adaptations by flora and fauna. • Local factors in ecological development and change (such as agriculture, urban change, the planned and unplanned introduction of new species).	**20** **AO1=10** **AO2=10**

		• The impacts of change and measures to manage these impacts. Conservation strategies and their implementation in specific settings. • Case study of a specified ecosystem at a local scale to illustrate and analyse key themes including the nature and properties of the ecosystem, human impact upon it and the challenges and opportunities presented in its sustainable development. **AO2** • Current attitudes towards sustainability and conservation twinned with greater flexibility at work and higher disposable incomes, has meant a greater demand for well-maintained local ecosystems. • Expect to see small scale case studies and examples of regeneration projects which have been highly successful at re-establishing a balanced small-scale ecosystem. This is usually twinned with the re-emergence of native specifies of flora and fauna. Also expect to see examples of community engagement in conservation and wellbeing projects. Such schemes have become increasingly common in recent years. • For example, in the Solway Dune restoration Project, as well as repairing dunes, conservationists from Amphibian and Reptile Conservation (ARC) and RSPB Scotland have created new shallow ponds across the site for the toads to breed in. This has proved invaluable for the recovery of the species but has also attracted a large number of visitors to the area. Whilst this has been of benefit in stimulating the local economy, the large numbers of visitors themselves have created issues. Noise, litter and air pollution have been unintended consequences of the restoration project. • The Mersey Forest Partnership has been established for over 25 years. It has been working to improve the local environment for the people of Merseyside and Cheshire. A strong focus of their work in recent years has been connecting people with nature to improve their wellbeing. They have set up a number of projects which bring together the concept of conservation and wellbeing, thus cementing the link between quality of life and conservation. • Cheshire's innovative Natural Health Service provides a range of activities to help local people engage with the natural environment. Nature based health walks target people with serious illness and support them in accessing their local environment. They offer practical conservation projects which help conserve the local environment but also improve strength and stamina through nature based conservation projects, boosting practical skills and confidence whilst benefiting local green spaces. Horticulture Therapy improves mental and physical wellbeing through food growing and gardening. Forest School/Bush Craft for Adults involve hands-on learning and play experiences within a woodland setting. These have been demonstrated to promote positive behavioural change in children. The project extends the principles of Forest School to adults too, combining physical activity and outdoor learning to inspire individuals of any age. • There are numerous examples where local organisations are becoming increasingly innovative in trying to engage local communities	

		to get involved in conservation, education and recreation. Credit any other valid approach.	

Marking grid for Question 6.8

Level/ Mark Range	Criteria/Descriptor
Level 4 (16–20 marks)	• Detailed evaluative conclusion that is rational and firmly based on knowledge and understanding which is applied to the context of the question. Interpretations are comprehensive, sound and coherent (AO2). • Detailed, coherent and relevant analysis and evaluation in the application of knowledge and understanding throughout (AO2). • Full evidence of links between knowledge and understanding to the application of knowledge and understanding in different contexts (AO2). • Detailed, highly relevant and appropriate knowledge and understanding of place(s) and environments used throughout (AO1). • Full and accurate knowledge and understanding of key concepts, processes and interactions and change throughout (AO1). • Detailed awareness of scale and temporal change which is well integrated where appropriate (AO1).
Level 3 (11–15 marks)	• Clear evaluative conclusion that is based on knowledge and understanding which is applied to the context of the question (AO2). • Generally clear, coherent and relevant analysis and evaluation in the application of knowledge and understanding (AO2). • Generally clear evidence of links between knowledge and understanding to the application of knowledge and understanding in different contexts (AO2). • Generally clear and relevant knowledge and understanding of place(s) and environments (AO1). • Generally clear and accurate knowledge and understanding of key concepts and processes (AO1). • Generally clear awareness of scale and temporal change which is integrated where appropriate (AO1).
Level 2 (6–10 marks)	• Some sense of an evaluative conclusion partially based upon knowledge and understanding which is applied to the context of the question (AO2). • Some partially relevant analysis and evaluation in the application of knowledge and understanding (AO2). • Some evidence of links between knowledge and understanding to the application of knowledge and understanding in different contexts (AO2). • Some relevant knowledge and understanding of place(s) and environments which is partially relevant (AO1). • Some knowledge and understanding of key concepts, processes and interactions and change (AO1). • Some awareness of scale and temporal change which is sometimes integrated where appropriate. There may be a few inaccuracies (AO1).
Level 1 (1–5 marks)	• Very limited and/or unsupported evaluative conclusion that is loosely based upon knowledge and understanding which is applied to the context of the question (AO2). • Very limited analysis and evaluation in the application of knowledge and understanding. This lacks clarity and coherence (AO2). • Very limited and rarely logical evidence of links between knowledge and understanding to the application of knowledge and understanding in different

	contexts (AO2). • Very limited relevant knowledge and understanding of place(s) and environments (AO1). • Isolated knowledge and understanding of key concepts and processes (AO1). • Very limited awareness of scale and temporal change which is rarely integrated where appropriate. There may be a number of inaccuracies (AO1).
Level 0 (0 marks)	• Nothing worthy of credit.