
A-level
GEOGRAPHY
PAPER 1

PHYSICAL GEOGRAPHY

Mark scheme

Specimen material

v1.1

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 Assessment Writer.

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 average 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.

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, ie 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.

Section A

Question 1 Water and carbon cycles

01	1	<p>Explain the concept of dynamic equilibrium in relation to the water cycle.</p> <p>Allow 1 mark per valid point with extra mark(s) for developed points (d).</p> <p>AO1</p> <ul style="list-style-type: none"> • Dynamic equilibrium refers to the tendency towards a natural state of balance within the hydrological cycle (1). • The cycle is a closed system as no water enters or leaves the system; it is simply recycled around the system (d) (1). • The drainage basin element of the hydrological cycle is an open system where the inputs and outputs can change (d) (1). • The dynamic equilibrium is easily upset by extreme events such as storms or droughts (1). • Human activity can also cause disruption to the dynamic equilibrium, eg by modifying the drainage basin (1). • This causes disruption or interference to the dynamic equilibrium and is evidenced through flooding for example (1). • Such events and processes cause sudden changes in the state of the system and disrupt or interfere with dynamic equilibrium as is the case with flooding (1). 	<p>4</p> <p>AO1=4</p>
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01	2	<p>Using Figure 1, analyse projected rainfall change in Africa.</p> <p>AO3 – There are a variety of ways of approaching this unseen material. Students are required to analyse rainfall variation and change of over time. Responses should use the resources effectively and appropriately showing understanding of the link between the two graphs. Expect to see analysis of patterns and identification of anomalies on both the graphs and map.</p> <p>Mark scheme</p> <p>Level 2 (4–6 marks)</p> <p>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.</p> <p>Level 1 (1–3 marks)</p> <p>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.</p> <p>Notes for answers</p> <p>AO3</p> <ul style="list-style-type: none"> • Analysis shows that overall Africa is expected to see an increase in the amount of rainfall for most months. The biggest increases appear to be in January, April and November (around 4 mm). • However, from May to September, this model suggests that rainfall will be lower than the 1986–2005 average by as much as 4 mm in August. • Some students may calculate this as a reduction from 67 to 63 mm. For many months, February, March, May and September, there is little change expected. • The map gives further information about how the changes identified may affect rainfall spatially across Africa. The north of Africa is broadly expected to experience little change. • A large group of countries stretching from Chad to Botswana in the south are set to experience an increase in rainfall of up to 20 mm. • Some may point to anomalies where rainfall is set to fall such as south-west Nigeria which is expected to experience up to a 25 mm reduction in rainfall. 	<p>6</p> <p>AO3=6</p>
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01	3	<p>Using Figure 2 and your own knowledge, assess the natural and human induced causes of the 2005 flood in Carlisle.</p> <p>AO1 – Knowledge and understanding of the causes of floods in drainage basins.</p> <p>AO2 – Application of knowledge to the conditions in this drainage basin. Suggested causes should show an understanding of the conditions within this location and how these human and physical conditions affect the flooding.</p> <p>Mark scheme</p> <p>Level 2 (4–6 marks)</p> <p>AO1 – Demonstrates clear knowledge and understanding of concepts, processes, interactions and change.</p> <p>AO2 – Applies knowledge and understanding to the novel situation offering clear analysis and evaluation drawn appropriately from the context provided. Connections and relationships between different aspects of study are evident with clear relevance.</p> <p>Level 1 (1–3 marks)</p> <p>AO1 – Demonstrates basic knowledge and understanding of concepts, processes, interactions, change.</p> <p>AO2 – Applies limited knowledge and understanding to the novel situation offering basic analysis and evaluation drawn from the context provided. Connections and relationships between different aspects of study are basic with limited relevance.</p> <p>Notes for answers</p> <p>AO1</p> <ul style="list-style-type: none"> • Natural processes operating at hill slope level and in drainage basins. • Inputs and outputs, to include precipitation, runoff; stores and flows, to include interception, surface, soil water, groundwater and channel storage; stemflow, infiltration overland flow, and channel flow. Concept of water balance. • Human impact upon drainage basins to include farming practices and land use changes. • Runoff variation and the flood hydrograph. <p>AO2</p> <ul style="list-style-type: none"> • Responses should note that prolonged periods of heavy rainfall prior to a storm appear to have contributed to the impact of antecedent rainfall. This antecedent rainfall referred to in the resource lead to full storage in groundwater and in the soil. Saturated ground prior to this event has exacerbated the impact 	<p>6</p> <p>AO1=2 AO2=4</p>
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		<p>of the subsequent storm. This almost certainly sped up overland flow/surface runoff during the storm which contributed to the 2005 Carlisle flood. Some may refer to full storage in groundwater and soil due to the antecedent rainfall.</p> <ul style="list-style-type: none"> • Expect to see connections made between drainage basin characteristics alluded to in the resource and the impact of the flooding – rock type and gradient have clearly contributed to the flashy nature of the storm hydrograph. Significant urbanisation and arable or grazing land may also feature as examples of human activity and land use change. This would suggest that any rain which did fall in the storm, was quickly channelled to the river through the urban drainage systems and through farmland drainage. Limited forestry in this area also suggests that there will be little interception further contributing to the flood. • As the storm progressed there was clearly a significant impact upon the river as a result of the conditions outlined above. Lag time to peak discharge was almost certainly very low. Expect to see reference to a ‘flashy’ storm hydrograph. There was likely to be significant flooding as a result of a combination of these factors. • There should be some explicit assessment, most likely to attribute the flood to a combination of atmospheric, local geological and human induced causes which led to the floods in 2005. 	
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01	4	<p>Assess the extent to which there are inter-relationships between processes in the water cycle and factors driving change in the carbon cycle.</p> <p>AO1 – Knowledge and understanding of processes in the water cycle and factors driving change in the carbon cycle.</p> <p>AO2 – Application of knowledge and understanding to assess the inter-relationships between processes in the water cycle and factors driving change in the carbon cycle. Response should come to a view in relation to extent of inter-relationships.</p> <p>Notes for answers</p> <p>AO1</p> <ul style="list-style-type: none"> • Processes in the water cycle which directly inter-relate to/with the carbon cycle. • Processes in the water cycle which do not relate to the carbon cycle. Evaporation and condensation are processes which are determined by the sun’s energy and the variation in temperature related to this. • Factors driving change in the magnitude of stores and transfers in the water cycle. These factors may relate to the sun’s energy as well as vegetation coverage in drainage basins. • Global distribution and size of major stores of water – lithosphere, hydrosphere, cryosphere and atmosphere. Some may structure 	<p>20</p> <p>AO1=10 AO2=10</p>
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		<p>their responses around the four major spheres and the inter-relationships which exist in these distinct zones.</p> <ul style="list-style-type: none"> • The role of transpiration in the carbon cycle may be considered as a specific example where there are clear interactions between the two cycles. • Global distribution, and size of major stores of carbon – lithosphere, hydrosphere, cryosphere, biosphere, atmosphere and the interactions with the water cycle which exists in these four major zones. • Factors driving change in the magnitude of carbon 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. Knowledge and understanding of the role of the water cycle should be applied here (See AO2) • 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. This case study may be used to exemplify some of the inter-relationships within the biosphere. <p>AO2</p> <ul style="list-style-type: none"> • Evaluation – Responses may challenge the theme of the question and suggest that the water cycle has many elements which are not inter-related to the carbon cycle. The basic elements of the water cycle involve the transfer of water through the lithosphere, hydrosphere, cryosphere and atmosphere. This is entirely driven by the sun’s energy and gravity and is independent of the carbon cycle. • Analysis – Water cycle transfers and stores within drainage basins may also be considered as processes. Infiltration and through flow for example can only occur in the presence of well-formed soils. The formation of soil structures is dependent upon factors driving change in the carbon cycle. • Analysis – A number of processes within the carbon cycle directly relate to the water cycle. Photosynthesis for example, converts the sun’s energy into chemical energy. This is completely reliant upon the presence of water for all plant growth. Transpiration may also be considered in this context. • Analysis – Decomposition is another important process in the carbon cycle. This activity is undertaken by detritivores which cannot operate without the presence of water in the areas where decomposition occurs. The detritivores themselves respire which is a key carbon process which can only operate in the presence of water, stored in soils and groundwater. It is important to note that some carbon is lost to the system due to detritivore respiration which can only take place in the presence of water, provided via precipitation. Some may use the tropical rainforest case studies to exemplify and support the analysis. • Analysis – Some may refer to the fact the carbon can be dissolved directly into large water bodies such as oceans, seas and lakes. Furthermore, carbon can be dissolved in precipitation 	
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		<p>as rain falls to the earth's surface. When dissolved in water, carbon dioxide reacts with water molecules and forms carbonic acid, which contributes to ocean acidity.</p> <ul style="list-style-type: none"> • Analysis and evaluation – Responses may also explore the inter-relationships between processes in the water cycle and factors driving change in the carbon cycle in a range of human activities and human life processes. This is a legitimate approach. • Analysis – Some may make further links eg to decomposition in periglacial areas (cryosphere) which is currently being exacerbated by climate change. The melting ice in the active layer is leading to rapid decomposition and a release of carbon dioxide and methane. • Analysis and evaluation – Natural fires may also be considered also act as process within the carbon cycle where there are inter-relationships with processes in the water cycle. Pyriscence for example has maturation and release of seeds which is triggered, in whole or in part, by fire or smoke; fire is a critical ingredient in the renewal of some ecosystems (biosphere). This is an example of where a factor driving change in the carbon cycle might impact processes in the water cycle. • Analysis and evaluation – Weathering is another process which releases carbon back to the atmosphere (lithosphere and hydrosphere). This requires the presence of water, usually through precipitation or under sea water weathering. This potentially reveals another link between precipitation and the carbon cycle. This potentially reveals another link between processes in the water cycle and the factors driving change in the carbon cycle. • Overall evaluation – More sophisticated responses should note that the carbon cycle is entirely dependent upon the water cycle for its existence. Without the cycling of water through the lithosphere, hydrosphere, cryosphere and atmosphere, there could be no carbon cycle. 	
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Marking grid for Question 1.4

Level/ Mark Range	Criteria/Descriptor
Level 4 (16–20 marks)	<ul style="list-style-type: none"> • 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)	<ul style="list-style-type: none"> • 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)	<ul style="list-style-type: none"> • 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)	<ul style="list-style-type: none"> • 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).

	<ul style="list-style-type: none"> • Isolated knowledge and understanding of key concepts and processes. • 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)	<ul style="list-style-type: none"> • Nothing worthy of credit.

Section B

Question 2 Hot desert systems and landscapes

02	1	<p>Outline the impact of temperature variation on weathering processes in hot deserts.</p> <p>Allow 1 mark per valid point with extra mark(s) for developed points (d).</p> <p>AO1</p> <ul style="list-style-type: none"> • The main impact is mechanical weathering (1). • The very high diurnal temperature variation causes rocks to break up due to the continued expansion and contraction caused by the regular heating and cooling (d) (1). • It is the very high temperatures during the day followed by the very low temperatures of the night which cause the main pressure (d) (1). • The very high temperatures also cause evaporation of any soil/ground moisture. This contributes to a lack of soil formation and vegetation growth, leaving the area open to further weathering processes (1). • Some may also refer to the very low temperatures, which in the presence of water, cause ice to form and freeze thaw weathering (1). • Some may refer to the debates about the relative importance of temperature variation (1). 	<p>4</p> <p>AO1=4</p>
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02	2	<p>Using Figure 3a and Figure 3b, compare the temperature variations for the Sahara Desert and the Sonoran Desert.</p> <p>AO3 – Responses should use the resources effectively and appropriately showing understanding of the graphs and of the link between the two graphs. Expect to see analysis patterns and identifies anomalies on both graphs.</p> <p>Mark scheme</p> <p>Level 2 (4–6 marks)</p> <p>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.</p> <p>Level 1 (1–3 marks)</p> <p>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.</p> <p>Notes for answers</p> <p>AO3</p> <ul style="list-style-type: none"> • Temperatures are largely higher in the Sahara with a range from around 25.2–27.3 °C; compared to 23–25.6 °C in the Sonoran desert. • The range appears to higher in the Sonoran desert compared to the Sonoran Desert. This is not a consistent pattern but average temperatures do appear to vary more substantially year on year for the Sonoran desert. • Both deserts appear to be experiencing a gradual, stepped increase in temperatures. • Peaks and troughs shows a mixed picture in terms of coincidence. In around 2003 there is some correlation in peaks. In 1995 the Sahara Desert was experiencing a trough (relative to its own temperature profile) of around 26.4 °C. However the Sonoran Desert was experiencing an above average profile of around 25.2 °C. • There are no signs of stabilisation with both showing continued variation and a general upward trajectory in temperature. • There is definite evidence of correlation in the stepped profile change for both deserts. Both appear to experience a step change at similar change and by similar increases in temperature. These dates are 1974, 1987 and 1998. 	<p>6</p> <p>AO3=6</p>
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02	3	<p>Using Figure 4 and your own knowledge, assess the benefits of the shelterbelt system in combatting desertification.</p> <p>AO1 – Knowledge and understanding of the process of desertification and measures to address this through sustainable practices.</p> <p>AO2 – Application of knowledge to the conditions in the shelter belt system. Suggested benefits should show an understanding of the conditions within this location and how the system generates environmental and human benefits.</p> <p>Mark scheme</p> <p>Level 2 (4–6 marks)</p> <p>AO1 – Demonstrates clear knowledge and understanding of concepts, processes, interactions and change.</p> <p>AO2 – Applies knowledge and understanding to the novel situation offering clear analysis and evaluation drawn appropriately from the context provided. Connections and relationships between different aspects of study are evident with clear relevance.</p> <p>Level 1 (1–3 marks)</p> <p>AO1 – Demonstrates basic knowledge and understanding of concepts, processes, interactions, change.</p> <p>AO2 – Applies limited knowledge and understanding to the novel situation offering basic analysis and evaluation drawn from the context provided. Connections and relationships between different aspects of study are basic with limited relevance.</p> <p>Notes for answers</p> <p>AO1</p> <ul style="list-style-type: none"> • The causes of desertification exacerbated by human activity. • The impact of desertification upon people and the environment. • The distribution of areas at risk from desertification. • Impact on ecosystems, landscapes and populations. • Alternative possible futures for local populations suffering from desertification. • The implications of desertification for sustainable development. • Evaluation of human responses of resilience, mitigation and adaptation. <p>AO2</p> <p>Any benefits reasonably derived from data are acceptable. The focus of the benefits should be based around the sustainability of the system for both the people and the environment. There may also be some consideration of alternative possible futures in this context:</p>	<p>6</p> <p>AO1=2 AO2=4</p>
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		<ul style="list-style-type: none"> • Surface roughness has increased due to the shrubs and grasses. This friction contributes to a reduction in wind speeds. As wind speed has decreased, this will reduce soil erosion as well as the moving around of sand particles. The lack of wind will also reduce moisture loss through evaporation. • Sand invasion has been reduced as a result of the vegetation cover and the reduced wind speed. The movement of the dunes will have been reduced. • The concentration of air humidity has increased due to forest transpiration. This is likely to support the creation of a microclimate which will further improve agricultural productivity as well as supporting the newly developed ecosystem. Some may refer to plagioclimax in this regard. • The forest network will be able to supply the human inhabitants with firewood, wood by-products and fodder for cattle. • Trees provide shade during the hot season for people and cattle. The coverage also reduces evaporation by reducing temperatures. • Local poverty may have decreased due to the large plantations of trees and the harvesting of food from agricultural produce. • There should be some overall assessment of the benefits ie there is considerable overall value in the shelterbelt system. It is supporting sustainable agriculture and conserving what is clearly a fragile environment at what appears to be relatively low cost. There are also clear links to sustainable economic development for local populations. 	
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02	4	<p>Assess the relative importance of the roles of water and wind in shaping desert landscapes.</p> <p>AO1 – Processes and landforms associated with water and wind in deserts.</p> <p>AO2 – Application of process to creation of the landforms and landscapes should address the ‘relative’ dimension. Responses are required to use their knowledge and understanding in order to analyse and evaluate the two types of process relative to each other and how these create contrasting landforms in arid landscapes.</p> <p>Notes for answers</p> <p>There must a clear engagement in the ‘relative importance’ dimension of the question. This is an opportunity for responses to show understanding of the emerging importance of the role of water in landform development, weathering and vegetation coverage.</p> <p>AO1</p> <ul style="list-style-type: none"> • Knowledge of the processes associated with water in deserts – exogenous, endoreic and ephemeral rivers; the episodic role of water; sheet flooding, channel flash flooding. There should be clear consideration of the role of water in shaping desert landscapes. • Knowledge and understanding of the processes associated with 	<p>20</p> <p>AO1=10 AO2=10</p>
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	<p>wind in deserts – erosion: deflation and abrasion; transportation; suspension, saltation, surface creep, deposition. There should be clear consideration of the role of wind in shaping desert landscapes.</p> <ul style="list-style-type: none"> • Knowledge and understanding of the landscapes associated with the action of water – wadis, bahadas, pediments, playas, inselbergs. These features may be used to exemplify the role of water in shaping desert landscapes. • Knowledge and understanding of the landforms/landscapes associated with wind – deflation hollows, desert pavements, ventifacts, yardangs, zeugen, barchans and seif dunes. These features may be used to exemplify the role of wind in shaping desert landscapes. • Sources of energy in hot desert environments: insolation, winds, runoff. Sediment sources, cells and budgets. These sources may be used to argue either in favour of wind or water, depending upon the context of argument presented. • Geomorphological processes: weathering, mass movement, erosion, transportation and deposition. There may be some links made to the role of water and/or wind in supporting these processes. • Distinctively arid geomorphological processes: weathering (thermal fracture, exfoliation, chemical weathering, block and granular disintegration). • Exemplification through place support may be a feature in showing where contrasting processes have created contrasting landscapes. <p>AO2</p> <ul style="list-style-type: none"> • Evaluation – The ‘relative importance’ element requires a consideration of whether water or wind is more important in the chosen landscape. There is no correct answer; this depends on the material chosen in support. Others may consider the interaction between wind and water and places where both processes act to shape the landscape. This is a legitimate approach. • Evaluation – In considering water and wind in conjunction, assessment should start to identify importance of either wind or water according to the location chosen. Case study support can be considered as application where it is specifically used to address the ‘relative roles of water and wind’ dimension of the question. • Analysis – For erosion, expect to see reference to how wind abrasional processes shape and scour the land. Yardangs and zeugens are likely to feature. Traditional views are that the action of wind has dominated the development of the desert landscape. • Analysis – For transport, expect to see reference to deflation hollows and this is likely to be linked with the creation of dunes. This should be associated with the action of wind. • Analysis – For deposition, dune formations are likely to be considered. • Analysis – Expect to see reference to the episodic role of water 	
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		<p>and the formation of wadis (dry river bed), bahadas (alluvial deposition), playa (dry lake bed), pediments (water eroded plain), inselbergs (rocky outcrops).</p> <ul style="list-style-type: none"> • Analysis and evaluation – It is important to note the role of water in deserts also extends to mechanical weathering processes. Diurnal temperature variation when supported by the presence of water is much more likely to accelerate the process of exfoliation. • Analysis – It is also important to consider the role of water in desert vegetation. In deserts, evaporation outweighs water inputs, leading to the formation of salt pans left stranded on the plains. The salt lakes unsurprisingly are highly saline, with high concentrations of soluble sodium salts. There are only very specialised halophytic vegetation. In sense the evaporation of water has had a direct bearing upon the salt pan landscape, but also associated vegetation. • Evaluation – More sophisticated responses should show that the role of water has been underestimated historically, but is now considered to be prominent (or at least of equal importance) in the creation of many distinctive landforms within the desert landscape. 	
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Marking grid for Question 2.4

Level/ Mark Range	Criteria/Descriptor
Level 4 (16–20 marks)	<ul style="list-style-type: none"> • 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)	<ul style="list-style-type: none"> • 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)	<ul style="list-style-type: none"> • 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)	<ul style="list-style-type: none"> • 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).

	<ul style="list-style-type: none"> • 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)	<ul style="list-style-type: none"> • Nothing worthy of credit.

Question 3 Coastal systems and landscapes

03	1	<p>Explain the concept of the sediment cell.</p> <p>Allow 1 mark per valid point with extra mark(s) for developed points (d).</p> <p>AO1</p> <ul style="list-style-type: none"> • A sediment cell is a closed system usually bounded by headlands or a change in longshore drift (1). • Within a sediment cell, there is erosion, transport and deposition of sediment within a long term cycle (1). • The only inputs into the sediment come from erosion from the sea bed or land (1). • There is little or no movement of sediment between cells (1). • Human activity such as beach management can interrupt the natural system creating imbalance within the cell leaving some areas at risk of erosion (1). 	<p>4</p> <p>AO1=4</p>
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03	2	<p>Complete Figure 5 and interpret your Chi-square result using Figure 6.</p> <p>AO3 Completion of the Chi-Squared calculation and use of significance table. Analysis of Chi-squared and the data set in support of interpreting the flood risk in different parts of the UK.</p> <p>Mark scheme</p> <p>1 mark per correct answer in completing the table. Max 3 as shown.</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th></th> <th style="text-align: center;">north west</th> <th style="text-align: center;">north east</th> <th style="text-align: center;">south west</th> <th style="text-align: center;">south east</th> <th style="text-align: center;">Total</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">O</td> <td style="text-align: center;">22</td> <td style="text-align: center;">16</td> <td style="text-align: center;">38</td> <td style="text-align: center;">20</td> <td style="text-align: center;">96</td> </tr> <tr> <td style="text-align: center;">E</td> <td style="text-align: center;">24</td> <td style="text-align: center;">24</td> <td style="text-align: center;">24</td> <td style="text-align: center;">24</td> <td style="text-align: center;">96</td> </tr> <tr> <td style="text-align: center;">O – E</td> <td style="text-align: center;">–2</td> <td style="text-align: center;">–8</td> <td style="text-align: center;">14</td> <td style="text-align: center;">–4</td> <td style="text-align: center;">-</td> </tr> <tr> <td style="text-align: center;">$\frac{(O - E)^2}{E}$</td> <td style="text-align: center;">4</td> <td style="text-align: center;">64</td> <td style="text-align: center;">196</td> <td style="text-align: center;">16</td> <td style="text-align: center;">-</td> </tr> <tr> <td style="text-align: center;">$\frac{(O - E)^2}{E}$</td> <td style="text-align: center;">0.17</td> <td style="text-align: center;">2.67</td> <td style="text-align: center;">8.17</td> <td style="text-align: center;">0.67</td> <td style="text-align: center;">$x^2 =$ 11.68</td> </tr> </tbody> </table> <p>Allow 1 mark if rounding is used eg $x^2 = 11.67$</p> <p>AO3 – Interpretation (3 marks)</p> <p>Allow one mark per valid point made.</p> <p>The x^2 figure of 11.68 exceeds both the 0.05 and 0.01 significance levels (1). This means that the null hypothesis can be rejected and that there is a significant difference in the location of the worst floods to affect Great Britain (1). There is a less than 1% probability that these results could occur by chance (1). Looking at the data, it is clear that flooding is much more likely (with statistical significance) to affect the south west compared to other locations, most notably the north east (1).</p> <p>Note: In order to avoid cumulative error, allow max three marks for correct interpretation against an incorrectly calculated x^2 figure.</p>		north west	north east	south west	south east	Total	O	22	16	38	20	96	E	24	24	24	24	96	O – E	–2	–8	14	–4	-	$\frac{(O - E)^2}{E}$	4	64	196	16	-	$\frac{(O - E)^2}{E}$	0.17	2.67	8.17	0.67	$x^2 =$ 11.68	6 AO3=6
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03	3	<p>Using Figure 7 and your own knowledge, assess the role of mass movement upon the development of this area of the Holderness coastal landscape.</p> <p>AO1 – Knowledge and understanding of the process of mass movement, its causes and associated landforms.</p> <p>AO2 – Application of this knowledge to the novel situation; specifically the aspects of rotational slumping and sliding. Clearly links the process to the development of the landscapes.</p> <p>Mark scheme</p> <p>Level 2 (4–6 marks)</p> <p>AO1 – Demonstrates clear knowledge and understanding of concepts, processes, interactions and change.</p> <p>AO2 – Applies knowledge and understanding to the novel situation offering clear analysis and evaluation drawn appropriately from the context provided. Connections and relationships between different aspects of study are evident with clear relevance.</p> <p>Level 1 (1–3 marks)</p> <p>AO1 – Demonstrates basic knowledge and understanding of concepts, processes, interactions, change.</p> <p>AO2 – Applies limited knowledge and understanding to the novel situation offering basic analysis and evaluation drawn from the context provided. Connections and relationships between different aspects of study are basic with limited relevance.</p> <p>Notes for answers</p> <p>AO1</p> <ul style="list-style-type: none"> • The geomorphological process of mass movement to include sliding and slumping. • Landforms/landscapes associated with mass movement. • Origin and development of landforms and landscapes of coastal deposition. <p>AO2</p> <ul style="list-style-type: none"> • Analysis and evaluation of the novel situation; specifically the aspects of rotational slumping and sliding. Clearly links the process to the development of this landscape. • Expect responses to examine the factors which may have led to mass movement. Whilst definitions are not required some will provide these. The key is the link between the mass movement process and the associated landscape. Some may consider the role of mass movement in modifying the shape and appearance of cliffs or other features such as the beach. • Consideration of rotational slumping or sliding which is an aspect of 	<p>6</p> <p>AO1=2 AO2=4</p>
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		<p>mass movement and again changes the shape of the cliff line by reducing the cliff angle.</p> <ul style="list-style-type: none">• Factors combine to cause the mass movement; most notably the unconsolidated materials (glacially deposited materials) which form the basis of a coastline experiencing such change; and the prevailing weather or climatic conditions which often leave the soil saturated causing the slump or slide to occur, mainly due to the lack of friction or resistance to collapse.	
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03	4	<p>‘No amount of coastal intervention by people can halt the natural processes which continue to present potentially serious risks to coastal communities now and even more so in the future.’</p> <p>To what extent do you agree with this view?</p> <p>AO1 – Knowledge and understanding of the physical processes affecting coastlines; those associated with waves, currents, tides, erosion, transport and deposition. Knowledge and understanding of eustatic and isostatic sea level change. Knowledge and understanding of the impact of coastal management.</p> <p>AO2 – Application of knowledge and understanding to analyse and evaluate how climate change links to sea level change and can exacerbate flooding and erosion as well as creating change to the physical landscapes (including landform development). There should be some evaluation of the extent to which the statement is valid.</p> <p>Notes for answers</p> <p>There are clear inter-related strands to this question. The focus is upon the challenges associated with coastal management. The assertion is that natural processes will prevail and that human activity designed to protect coastlines is effectively a waste of time and money. There is also an aspect of alternative possible futures. Responses should look ahead and integrate the changing coastal dynamic into their responses.</p> <p>AO1</p> <ul style="list-style-type: none"> • A range of processes affecting coastlines. Expect to see reference to: waves (constructive and destructive); prevailing currents; the role of wind its connection to fetch. • Erosional processes and associated landforms – abrasion, attrition, hydraulic action and solution – landscapes of erosion may feature. • Transportation processes of traction, saltation, solution and suspension. Links to longshore drift are likely. Some may connect wave action and longshore drift. • Deposition should feature in relation to a variety of landforms such as beach, dunes, spits and bars. • The contribution of these processes (erosion, transport and deposition) to the development of low and high energy environments may also feature. Expect to see stronger focus upon high energy environments with links to erosional coastlines and those at risk of flooding. • Coastal management strategies to include hard engineering soft engineering and other approaches such as managed retreat. • Alternative possible futures should emerge and include the potential impact of sea level change upon both process, landform, but also how this impacts upon attitudes to coastal management. • Risks associated with living along coastlines under threat from erosion and flooding. • Learned case study support may be used to exemplify. 	<p>20</p> <p>AO1=10 AO2=10</p>
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	<p>Many will use case studies from within the UK and beyond the UK in supporting their responses.</p> <p>AO2</p> <ul style="list-style-type: none"> • Evaluation – some debate is encouraged here. Some coastlines are coping relatively well with issues arising out of natural processes. Estuaries such as the Thames, with considerable financial investment in flood and erosion defence schemes, is well protected against the natural processes threatening it. • Analysis – In the UK, expect to see reference to locations/coastlines such as Happisburgh. Here isostatic changes are combining with a eustatic rise in sea level to create significant risk of flooding and erosion. Also local geology is adding to the issue as the rocks are easily eroded. Added to this, both areas are relatively close to sea level, just a few metres above. • Evaluation – Some may engage in a debate around the value of intervention. Responses are likely to consider the challenges of defending coastal locations in a financial climate of scarce resources. Policy dilemmas associated cost and options such as with managed retreat are likely to feature. This may be linked to the 'knock-on effects' of intervention in natural processes. Interference in the movement of beach material in sediment cells is credited with causing considerable issues in places where no management exists. • Analysis and evaluation – Some students may use recent storm events as part of a case study to exemplify the impact on the local area and how these events are forecast to increase in frequency and severity as a result of climate change. This is one alternative possible future associated with increased flooding. • Evaluation – Further abroad, some may consider locations such as the Maldives, whose very existence is under threat as a result of sea level change. The highest point of the Maldives is only 8 m above sea level. • Analysis and evaluation – Some may suggest that impacts of climate change are minimal due the actions of people in mitigation. For example, mitigation against the impact of sea level rise in the Maldives through a combination of hard and soft engineering strategies, such as the development of mangrove and the hard engineering work taking place around the islands economic hubs, such as the capital, Malé. • Overall evaluation is likely to acknowledge that coastal management is set to become an increasingly challenging issue for governments around the world over the coming decades. Whilst it is possible to interfere with natural processes, human induced climate change and the scarcity of financial resources make decisions about where to protect and how much to invest extremely difficult. Places such as the Maldives have no real viable future if the climate models and expected sea level changes emerge. Other places such as the Netherlands have managed to fight these natural processes with massive financial investment and considerable technological advancement. 	
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Marking grid for Question 3.4

Level/ Mark Range	Criteria/Descriptor
Level 4 (16–20 marks)	<ul style="list-style-type: none"> • 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)	<ul style="list-style-type: none"> • 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)	<ul style="list-style-type: none"> • 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)	<ul style="list-style-type: none"> • 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).

	<ul style="list-style-type: none"> • 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)	<ul style="list-style-type: none"> • Nothing worthy of credit.

Question 4 Glacial systems and landscapes

04	1	<p>Explain the development of warm based glaciers.</p> <p>Allow 1 mark per valid point with extra mark(s) for developed points (d).</p> <p>AO1</p> <ul style="list-style-type: none"> • Ice which has its temperature close to freezing throughout its depth will contribute to the creation of a warm based glacier (1). • Temperatures are higher due to the surrounding atmospheric and environmental conditions (d) (1). • Ice can also melt where the thickness increases (1). • The increased thickness of the ice causes the pressure melting point to fall (1). • Ice melts to form water at the base of the glacier, allowing the glacier to 'slide' (1). 	<p>4</p> <p>AO1=4</p>
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04	2	<p>Using Figures 8, 9 and 10, compare the differences between the glaciers.</p> <p>AO3 – Uses graphical skills to interpret and analyse data. Uses the map and graphs in conjunction with each other to draw appropriate comparisons around the differences between the glaciers.</p> <p>Mark scheme</p> <p>Level 2 (4–6 marks)</p> <p>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.</p> <p>Level 1 (1–3 marks)</p> <p>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.</p> <p>Notes for answers</p> <p>AO3 This question requires analysis and interpretation of the resource.</p> <ul style="list-style-type: none"> • Based upon the 1965 reference year, all glaciers are experiencing a reduction in their mass balance over the period in question. There are clearly differential rates of reduction/ablation. • The Wolverine glacier has seen the slowest rate of decline but is still –15 m compared to the reference year by 2012. It is the only glacier which experienced an increase in its mass balance above the 1965 baseline between 1980 and 1990, although even then there was fluctuation. The Gulkana glacier on the other hand has seen a steady decline to around –26 m by 2012. The most rapid rate of decline has been the South Cascade Glacier and this has fluctuated a lot within an overall pattern of decline. • This should be supported by use of Figure 9 which shows how annual advance and retreat lead to a net gain or loss in the mass balance. Responses should evidence the link between Figures 9 and 10. • The Gulkana glacier is experiencing the lowest annual variation and lowest amount of net loss (figures should be used to support. This may be compared with the map evidence i.e. Gulkana is further north and the furthest inland. • Some may connect the comparison to the map evidence provided eg Wolverine Glacier is in higher latitudes than South Cascade. 	<p>6</p> <p>AO3=6</p>
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04	3	<p>Figure 11 and Figure 12 show information about the active layer and ground temperature in Svalbard, which is within the Arctic Circle. Figure 13 provides further information about the island of Svalbard.</p> <p>Using Figure 11, Figure 12, Figure 13 and your own knowledge, assess the potential impact of these data upon this area.</p> <p>AO1 – Demonstrates knowledge and understanding of the link between climate and permafrost in periglacial areas. Periglacial features and processes: permafrost, active layer and mass movement.</p> <p>AO2 – Applies knowledge and understanding to this novel situation by suggesting reasonable impacts of climate change upon the active layer and further ramifications of this.</p> <p>Mark scheme</p> <p>Level 2 (4–6 marks)</p> <p>AO1 – Demonstrates clear knowledge and understanding of concepts, processes, interactions and change.</p> <p>AO2 – Applies knowledge and understanding to the novel situation offering clear analysis and evaluation drawn appropriately from the context provided. Connections and relationships between different aspects of study are evident with clear relevance.</p> <p>Level 1 (1–3 marks)</p> <p>AO1 – Demonstrates basic knowledge and understanding of concepts, processes, interactions, change.</p> <p>AO2 – Applies limited knowledge and understanding to the novel situation offering basic analysis and evaluation drawn from the context provided. Connections and relationships between different aspects of study are basic with limited relevance.</p> <p>Notes for answers</p> <p>AO1</p> <ul style="list-style-type: none"> • Periglacial features and processes: permafrost, active layer and mass movement. • Periglacial landforms: patterned ground, ice wedges, pingos, blockfields, solifluction, lobes, terracettes, thermokarst. Characteristic 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. 	<p>6</p> <p>AO1=2 AO2=4</p>
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	<p>AO2</p> <ul style="list-style-type: none"> • The basic impact of climate change on periglacial areas is that the permanently frozen ground starts to thaw which is evidenced in the increasing depth of the active layer over the study period. The depth of the active layer has increased. This then creates a series of knock on effects as the active layer thaws. • Solifluction may increase causing soil erosion. Also the slope failure may occur in particular circumstances. In higher altitudes avalanche and rock fall may occur. Flooding and waterlogging will potentially affect periglacial areas with this extra melting. • Decomposition processes associated with the carbon cycle are likely to restart. This is a potentially significant contributor to issues associated with global warming. The restarting of the carbon cycle is likely to lead to significant release of both carbon and methane. Whilst this is a global impact (and not this area), the longer term impact will be felt back in Svalbard and the upward trajectory of temperatures continues. In other words a vicious circle is in danger of ensuing. • Some may go further and link these physical impacts to human activity and consequences for people and communities. Expect to see reference to the impact of thawing ground on transport, construction and economic activity such as tourism. This is a legitimate approach. • More sophisticated responses should note that the borehole temperatures are increasing. Whilst still below freezing point the bore hole at 15 m is experiencing a significant upward trend. Whilst this is at significantly greater depth than the active layer, the upward increase in temperature suggests that it will not be long before the active depth extends down towards these sorts of depth. This will further exacerbate the issues above. 	
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04	4	<p>Assess the relative importance of water and ice in the development of landscapes of glacial and periglacial deposition.</p> <p>AO1 – Knowledge and understanding of the roles of ice and water in shaping glacial and periglacial landscapes of deposition.</p> <p>AO2 – Applies knowledge and understanding to the context of the question in analysing and evaluating the aspect of relative importance. Compares, contrasts and shows the inter-relationships between water and ice.</p> <p>Notes for answers</p> <p>AO1</p> <ul style="list-style-type: none"> • The physical characteristics of cold environments: Climate. This is important in identifying that climate has a direct impact on the presence of ice or water (or both) in cold environments. • The global distribution of past and present cold environments (polar, alpine, glacial and periglacial) and of areas affected by the Pleistocene glaciations. This depends upon the thrust of the response. Responses should see the link between the climate and the geographical location, perhaps referring to latitude, continentality and/or altitude. • Glacial systems to include the concept of the glacial budget. Ablation and accumulation – historical patterns of ice advance and retreat. Those considering ablation will see the link between glacial and fluvioglacial deposition. • Warm and cold based glaciers: characteristics and development. These types should be linked to glacial and fluvioglacial deposition. • Geomorphological processes – weathering: frost action, nivation; ice movement: internal deformation, rotational, compressional, extensional and basal sliding; transportation and deposition. This may be used to support analysis around the sources of materials for deposition by both water and ice. • Fluvioglacial processes: meltwater, erosion transportation and deposition. • Periglacial features and processes: permafrost, active layer and mass movement. Periglacial landforms: patterned ground, ice wedges, pingos, blockfields, solifluction, lobes, terracettes, thermokarst. Characteristic periglacial landscapes. This may be used to support analysis around the development of solifluction lobes. Origin and development of landforms and landscapes of glacial deposition: drumlins, erratics, moraines, till plains. Characteristic glaciated landscapes. • Fluvioglacial landforms of deposition: kames, eskers, outwash plains. Characteristic fluvioglacial landscapes. There should be clear links to climate and geographical location in differentiating the role of fluvioglacial and glacial deposition. <p>AO2</p> <ul style="list-style-type: none"> • Analysis – Expect to see students categorise deposition into the 	<p>20</p> <p>AO1=10 AO2=10</p>
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		<p>depositional action of the ice, ie formations of moraine and how this is linked but distinct from fluvio-glacial deposition.</p> <ul style="list-style-type: none"> • Analysis – In order to develop their ideas around deposition of moraine (ground, terminal, medial, lateral, englacial and supra glacial moraine) responses are first likely to consider erosional processes of plucking and abrasion. This is a reasonable approach as long as the response does not drift too far away from the main thrust. The associated moraines should be considered as glacial drift. The till associated with the glacier is then responsible for creating a very distinct glacial topography comprised of a number of distinct landforms – expect to see reference to drumlins, erratics. • Analysis – Kame and eskers should be juxtaposed with glacial deposition. Whereas moraine is dumped insitu as unsorted regolith. Fluvioglacial deposition occurs under the ice in englacial tunnels leading to the formation of sinuous eskers. Kames form at the margins of the ice and the valley side. The commonality is that both are features of the action of water as opposed to the dumping insitu by melting ice. • Analysis – Some students will consider the link between the moraine and the melting ice at the snout. As ablation occurs, the melting ice releases large volumes of water which then acts to sort the sediments at and beyond the snout. The formation of fluvio glacial deposits is distinct from glacial deposits because, in the main, these deposits are well sorted according to size and weight. Expect to see reference to outwash plains, meltwater channels, braided streams and proglacial lakes. • Analysis – More sophisticated responses may consider periglacial environments where it is combination of freezing and thawing which creates the distinctive landscape features. It is not possible to distinguish processes of erosion transport and deposition in the creation of these landscapes. It is combined action of ice and water which creates features such as solifluction lobes. • Evaluation should recognise that in periglacial environments, it is the combined action of water and ice which generates these deposition landforms ie water and ice are equally important. It is, by definition the freezing and thawing which is responsible for the creation of the distinctive landscape. • Overall Evaluation – Most should conclude that it is the geographical location which determines the relative importance in this regard eg in valley glaciers moraine (and therefore ice) dominated deposition occurs at the margins of the glacier. At the snout, where ablation occurs, fluvio-glacial deposition occurs. 	
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Marking grid for Question 4.4

Level/ Mark Range	Criteria/Descriptor
Level 4 (16–20 marks)	<ul style="list-style-type: none"> • 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)	<ul style="list-style-type: none"> • 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)	<ul style="list-style-type: none"> • 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)	<ul style="list-style-type: none"> • 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).

	<ul style="list-style-type: none"> • 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)	<ul style="list-style-type: none"> • Nothing worthy of credit.

Section C

Question 5 Hazards

05	1	<p>Outline processes which lead to the formation of fold mountains.</p> <p>Allow 1 mark per valid point with extra mark(s) for developed points (d). For example:</p> <p>AO1 –</p> <ul style="list-style-type: none"> • Fold mountains are product of the convergence of tectonic plates (1). • Continental and / or ocean plates are forced together (1). This may be as a result of opposing convection currents or as a result of concepts associated with slab pull and ridge push (d) • Some may refer to continental fold mountain formation which crust is less dense, forced together with a crumpling effect (1) whereby continental mass is warped and forced upwards (d). • Others may consider the relationship between continental and ocean crust whereby the more dense ocean crust is forced into the mantle (1) leading to uplift of the continental crust(d). These fold mountains such as the Andes are also associated with volcanic activity (d). <p>The notes for answers are not exhaustive. Credit any valid points.</p>	<p>4</p> <p>AO1=4</p>
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05	2	<p>Using Figure 14 and Figure 15, assess the scale of the eruption.</p> <p>AO3 – There are two resources to use in conjunction with each other. The skills relate to satellite image interpretation and cartographical skills. This interpretation will allow for the assessment of scale but will support comment related to the analysis of evidence.</p> <p>Mark scheme</p> <p>Level 2 (4–6 marks)</p> <p>AO3 – Clear analysis and interpretation of the quantitative and qualitative evidence provided, which makes appropriate use of data in support. Clear connection(s) between different aspects of the data and evidence.</p> <p>Level 1 (1–3 marks)</p> <p>AO3 - Basic analysis and 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.</p> <p>Notes for answers</p> <p>AO3</p> <ul style="list-style-type: none"> • Figure 14 suggests a very large scale eruption with the ash cloud drifting away from the source to the south of the island. The red box indicates the immediate area affected around 175 km². The ash cloud then disperses away from Iceland and is blown to the east, north east and south. • There are two distinctions in the cloud evident by referring to Figure 15. This resource distinguishes between the area of ash cloud contamination from 0 to 20 000 ft and the area from 20 000 to 35 000 ft. There is lots of overlap between the two areas affected. • Some may point to a limitation of the resource in the way it appears to indicate sharp boundary change when the likelihood is of a more gradual change. • Both areas cover much of Europe (apart from the south) and into the western part of Russia. • There seems to be curious anomaly in the area to the north of Scandinavia. A relatively narrow strip of land is not affected at 0 to 20 000 ft. Similarly a large area in central Europe is not affected at 20 000 to 30 000 ft. There is also a curious shape to the area affected at 20 000 to 30 000 ft to the south west of the map which may represent a limitation to the resource. • The summary should conclude that a very large part of Europe and Russia was affected at 0 to 35 000 ft. 	<p>6</p> <p>AO3=6</p>
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05	3	<p>To what extent do you agree that seismic events will always generate more widespread and severe impacts than volcanic events?</p> <p>AO1 – Knowledge and understanding of a range of impacts of volcanic and seismic hazards.</p> <p>AO2 – Application of knowledge and understanding to bring specification areas together and to analyse and evaluate, based upon evidence about which types of hazard are more severe and/or widespread. There should be some explicit assessment regarding the extent.</p> <p>Mark scheme</p> <p>Level 3 (7–9 marks)</p> <p>AO1 – Demonstrates detailed knowledge and understanding of concepts, processes, interactions and change. These underpin the response throughout.</p> <p>AO2 – Applies knowledge and understanding appropriately with detail. Connections and relationships between different aspects of study are fully developed with complete relevance. Analysis and evaluation is detailed and well supported with appropriate evidence. A well balanced and coherent argument is presented.</p> <p>Level 2 (4–6 marks)</p> <p>AO1 – Demonstrates clear knowledge and understanding of concepts, processes, interactions and change. These are mostly relevant though there may be some minor inaccuracy.</p> <p>AO2 – Applies clear knowledge and understanding appropriately. Connections and relationships between different aspects of study are evident with some relevance. Analysis and evaluation evident and supported with clear and appropriate evidence. A clear but partial argument is presented.</p> <p>Level 1 (1–3 marks)</p> <p>AO1 – Demonstrates basic knowledge and understanding of concepts, processes, interactions and change. This offers limited relevance with inaccuracy.</p> <p>AO2 – Applies limited knowledge and understanding. Connections and relationships between different aspects of study are basic with limited relevance. Analysis and evaluation basic and supported with limited appropriate evidence. A basic argument is presented.</p> <p>Notes for answers</p> <p>The direction of the response largely depends upon the argument that</p>	<p>9</p> <p>AO1=4 AO2=5</p>
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the student wishes to put forward.

AO1

- When considering volcanic hazards expect to see reference to pyroclastic flows, lava flows, volcanic bombs, ash clouds and seismic activity (at the volcano). Some may bring case study material to the response and consider the impacts of these events and particularly violent events.
- Some may go further and contrast impacts in different places around the world such as Chaiten in Chile (2008) with Mt Etna in Italy (ongoing eruptions).
- For seismic events – hazards will mainly relate to the violent shaking and the associated damage to the built environments, to include and wider infrastructural damage.
- Some may consider tsunamis as a hazard created by seismic events.
- Case studies are likely to include Japan 2011 or the Indian Ocean Tsunami in 2004. These may be contrasted with major events such as Haiti in 2010 or Sichuan in 2008.

AO2

- Evaluation – Overall it is extremely difficult to generalise as each is event is unique. However seismic events on land tend to generate extremely severe impacts particularly where the earthquake epicentre strikes a large urban area. Seismic events are also generally associated with more deaths than volcanic events. Management is also a factor in the sense that many countries have mechanisms in place to mitigate against the impact of such hazards, thus reducing the impact and severity. The ash cloud associated with volcanic eruptions can cause very widespread impacts, more widespread than seismic events which tend to cause more localised and severe damage.
- Evaluation – An exception to this is a supervolcano eruption. Whilst there are no recorded incidents of such eruptions, the geological record and structure of places such as Yellowstone, USA tells us that a caldera exists and a supervolcanic eruption could occur. Modelling of a potential eruption suggests the potential for enormous devastation with average global temperature reduction of up 20 °C, due to the generation of a vast ash cloud. More locally, millions of Americans would be killed and up to two thirds of the USA would become uninhabitable.
- Analysis and evaluation – For the ‘widespread’ element of the question, it is reasonable to consider events such as the Icelandic volcano (2010) and suggest that the potential impact upon aviation and therefore the regional economy is much more severe than any seismic event. Specific case study knowledge may be applied to support this position.
- Analysis and evaluation – Others may contrast based upon income levels of countries, asserting that impacts tend to be managed more effectively in higher income countries, ie it is not seismic or volcanic nature which determines the scale of impact, but it is the location.

05	4	<p>Assess the importance of factors in globalisation in supporting the response to major seismic hazards.</p> <p>AO1 – Knowledge and understanding of aspects of globalisation and global interdependence, including factors in globalisation. Knowledge and understanding of the response to seismic events.</p> <p>AO2 – Application of knowledge and understanding in analysing and evaluating the benefits of globalisation in supporting the response to hazards.</p> <p>Mark scheme</p> <p>Level 3 (7–9 marks)</p> <p>AO1 – Demonstrates detailed knowledge and understanding of concepts, processes, interactions and change. These underpin the response throughout.</p> <p>AO2 – Applies knowledge and understanding appropriately with detail. Connections and relationships between different aspects of study are fully developed with complete relevance. Analysis and evaluation is detailed and well supported with appropriate evidence. A well balanced and coherent argument is presented.</p> <p>Level 2 (4–6 marks)</p> <p>AO1 – Demonstrates clear knowledge and understanding of concepts, processes, interactions and change. These are mostly relevant though there may be some minor inaccuracy.</p> <p>AO2 – Applies clear knowledge and understanding appropriately. Connections and relationships between different aspects of study are evident with some relevance. Analysis and evaluation evident and supported with clear and appropriate evidence. A clear but partial argument is presented.</p> <p>Level 1 (1–3 marks)</p> <p>AO1 – Demonstrates basic knowledge and understanding of concepts, processes, interactions and change. This offers limited relevance with inaccuracy.</p> <p>AO2 – Applies limited knowledge and understanding. Connections and relationships between different aspects of study are basic with limited relevance. Analysis and evaluation basic and supported with limited appropriate evidence. A basic argument is presented</p>	<p>9</p> <p>AO1=4 AO2=5</p>
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	<p>Notes for answers</p> <p>AO1</p> <ul style="list-style-type: none"> • Factors in globalisation include the development of technologies, systems and relationships, including financial, transport, security, communications, management and information systems and trade agreements. All of these factors have supported the process of globalisation, but also in times of crisis provide the same vehicles to provide essential support to countries suffering the impacts of natural disasters such as seismic hazards. • Case studies may include Japan 2011 or the Indian Ocean Tsunami in 2004 as major seismic events needing integrated international effort as part of a global response. Other seismic events such as Haiti in 2010 or Sichuan in 2008 may also feature. The focus must consider responses to the event. <p>AO2</p> <ul style="list-style-type: none"> • Analysis – In a crisis following a global seismic event, factors in globalisation invariably support the response to the event. • Analysis – Technology is used to aid communication and transport bringing immediate relief to affected areas. • Analysis – Technology allows family members to communicate across great distances, especially important in times of crisis where families are separated. • Analysis – Countries use their own aid budgets to support seismic events which require the combined efforts of nations to support in response, especially important where countries lack the resource to address the issues independently. • Evaluation – It really depends upon the supporting material but there must be some assessment of the value/importance of the support facilitated by global action in responding to seismic events. • Evaluation – More sophisticated responses should show awareness of the lack of consistency around the global response to seismic hazards. There are a number of complicating issues which factors in globalisation cannot alone solve. Political alliances/situations, stages of development, levels of corruptions and internal conflicts are just some of the issues which hinder the response to major seismic events. • Overall evaluation – There should be some overall assessment of the importance of factors in globalisation in supporting the response to seismic hazards. 	
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05	5	<p>‘The Disaster Response Curve (The Park Model) has contributed to improved understanding and therefore management of the impact of tropical storms.’</p> <p>To what extent do you agree with this view?</p> <p>AO1 – Knowledge and understanding of the theoretical approaches to hazard management. Knowledge of hazards associated with tropical storms.</p> <p>AO2 – Application of knowledge and understanding in analysis and evaluation of the extent to which theoretical models can assist in developing understanding of the management of the impact of tropical storms. There should be some evaluation of the extent to which the statement is valid.</p> <p>Notes for answers</p> <p>AO1</p> <ul style="list-style-type: none"> • The Park Model (some may refer to the Disaster Response Curve) – How this model can be used to identify the stages in the recovery of a community from a natural disaster. There should be knowledge and understanding of how the model can assist in the planning for future hazards and therefore improve outcomes of future of events by reducing impacts. • Human responses of adaptation mitigation and prediction in the management of hazards. • Other human responses such as fatalism and risk sharing. These may be considered as other factors which contribute to improved understanding and response to hazards. • Other models associated with natural disasters such as the Hazard Management Cycle. This model has similarities and differences with Park’s model. The role of expertise is a feature in the hazard management cycle but this is not referred to in Park’s Model. • Knowledge and understanding of the hazards associated with tropical storms. These impacts follow many similarities where the storms occur. However, there are also difference depending upon the choice of supporting material and exemplification. • Management of the hazards associated with tropical storms such as early warning, meteorological tracking, building design, evacuation planning, exclusion zones, land use planning and modification of the loss. These should be considered in the context of Park’s model, i.e. where each aspect of management fits within the model. • Impacts and human responses as evidenced by two recent tropical storms in contrasting areas of the world. This support may be used to challenge or support the thrust of the statement posed in the question. 	<p>20</p> <p>AO1=10 AO2=10</p>
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		<p>AO2</p> <ul style="list-style-type: none"> • The response should be framed in the context of an analysis and evaluation of the effectiveness of the Park Model in understanding and therefore managing the impact of tropical storms. • Analysis – By analysing the model in advance of an impending storm, planners can ascertain the normal progression through a disaster. This will enable advanced planning to take place to mitigate against the expected impacts of the storm. • Analysis – responses may explore various stages in the model and link this to management of tropical storms. More sophisticated responses may not start their analysis at stage one. Planners and managers invariably start at stage 5 ie what can be learned from a previous disaster. From this arises the mitigation strategies: <ul style="list-style-type: none"> • Hazard Resistant Design – this focuses on protection against both the storm surge and wind hazards. The storm surge hazard can be reduced by engineering structures such as sea walls, breakwaters, flood barriers and levees. Levee failure was a major cause of the flooding in New Orleans during Hurricane Katrina. • Building design (mitigation and/or adaptation depending on approach taken) can protect against the storm surge by raising the building on stilts, and by using concrete or brick rather than wood or straw which can be more easily swept away. Building design can do much to reduce the wind hazard. • Prediction and warning – coastal areas at risk of flooding are protected by warning systems. These aim to monitor tropical cyclone development and forecast their intensity and tracks so that the population can prepare themselves by moving to shelters or by evacuating their property and moving away from the danger area temporarily. • Predictions are based on models of atmospheric circulation and tracks of previous hurricanes. The difficult part of the process is interpreting the data for warning purposes. If the population at risk are warned and evacuated then lives may be saved. However, if warnings prove wrong there are high economic losses from evacuation and therefore lost production. There is also the impact on the population in terms of their reaction to future warnings. Too many erroneous warnings may produce complacency, and warnings must be issued in a way which will not cause panic. • Community Preparedness (mitigation and adaptation depending on approach taken) – if warnings are to be effective, the authorities and public must be aware of the specific actions to take. Dissemination of information to the public and evacuation procedures need to be planned in advance. • Land Use Planning (mitigation and/or adaptation depending on approach taken) – is most effective in the coastal zone most at risk from storm surges. Past tropical cyclone data and coastal topography can be used to identify areas at high risk. The aim is to limit development in these areas to uses more compatible with flooding such as beaches and parkland. • Beware of lengthy description of management strategy. There 	
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		<p>should be clear reference to the extent to the strategy ‘fits’ within Park’s Model and has contributed to improved understanding and therefore response. Some may evaluate each approach, but this must be undertaken within the context of the question.</p> <ul style="list-style-type: none"> • Analysis – There are a variety of time scales in which the Park Model operates could take in response to this question. Some may frame their responses within these different time scales. Management at different time scales: • Short term – Stage 1 – eg prediction • Medium term Stages 2, 3 and 4 – eg relief efforts, initial recovery aiming for normality • Longer term – Stage 5 – eg revised management plans aiming to prevent repetition, rebuilding and improving systems of prediction and protection, investment to restore/improve normality. • Evaluation – Some may refer to alternative models which provide a contrasting approach to hazard management. The hazard management cycle may be compared with the Park model. • Evaluation – Whatever the approach, there should be some explicit evaluation which addresses the extent to which the Park Model is useful. Students are free to argue either for or against the idea theoretical modelling, but this should be based upon preceding content. 	
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Marking grid for Question 5.5

Level/ Mark Range	Criteria/Descriptor
Level 4 (16–20 marks)	<ul style="list-style-type: none"> • 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)	<ul style="list-style-type: none"> • 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)	<ul style="list-style-type: none"> • 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)	<ul style="list-style-type: none"> • 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).

	<ul style="list-style-type: none"> • 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)	<ul style="list-style-type: none"> • Nothing worthy of credit.

Question 6 Ecosystems under stress

06	1	<p>Explain the concept of sub climax in succession.</p> <p>Allow 1 mark per valid point with extra mark(s) for developed points (d). For example:</p> <p>AO1</p> <ul style="list-style-type: none"> • Sub climax vegetation has not been able to mature to the natural climatic climax vegetation for the region (1). • This is because of an arresting factor (1). The arresting factor is a local factor which has prevented the natural progression of the vegetation to climax (d). • There are many types of arresting factor. Some may argue that human interference is an arresting factor (1). The plagio-climax is in effect the sub climax community. For example, a managed park, upland moor or golf course is prevented from reaching maturity because of the human activity (d). • Others may refer to a river flood, a change in topography or rock type, all of which can affect the ability of the local area to sustain the climax community (1+1 with development). <p>The notes for answers are not exhaustive. Credit any valid points.</p>	<p>4</p> <p>AO1=4</p>
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06	2	<p>With reference to any two biomes shown in Figure 16 and Figure 17, analyse the relationship between climate characteristics and natural vegetation.</p> <p>AO3 – Analyses data from the graph and data table to build a picture of the climate characteristics of the two biomes. This is then used to account for the differences in productivity.</p> <p>Mark scheme</p> <p>Level 2 (4–6 marks)</p> <p>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.</p> <p>Level 1 (1–3 marks)</p> <p>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.</p> <p>Notes for answers</p> <p>The response will depend upon the choice of biomes.</p> <p>For example: Temperate seasonal forest versus tropical rainforest.</p> <p>AO3</p> <p>These biomes are found in markedly different climatic conditions.</p> <ul style="list-style-type: none"> • Temperate seasonal forest is found in places with average temperatures of around 5 to 20 °C. Precipitation rates range from 3000 to 2300 mm per year. • Tropical rainforests on the other hand are found in places with much higher temperatures (20 to 30 °C) and significantly higher rainfall (2300 to 4300 mm per year). • Expect to see some manipulation of data as part of the analysis of the relationship. • Analysis should link the graph to the table of data. For example, tropical rainforests appear to have the best conditions for growth due to the favorable climate. • This should be correlated with the highest net primary productivity which suggests that these environments broadly present the best opportunities for natural vegetation growth. Figures associated with net primary productivity and/or mean biomass should feature. Again manipulation should be evident. • This may be contrasted with areas of low/lower net primary productivity or mean biomass such as the temperate deciduous woodland. 	<p>6</p> <p>AO3=6</p>
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06	3	<p>With reference to a tropical rainforest, evaluate the role of governance in environmental management.</p> <p>AO1 – Knowledge and understanding of the management issues in tropical rainforests. Knowledge and understanding of the role of governance.</p> <p>AO2 – Application of knowledge and understanding to show evaluation of the role of governance and how this is applied to tropical rainforests.</p> <p>Mark scheme</p> <p>Level 3 (5–9 marks)</p> <p>AO1 – Demonstrates detailed knowledge and understanding of concepts, processes, interactions and change. These underpin the response throughout.</p> <p>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. A well balanced and coherent argument is presented.</p> <p>Level 2 (4–6 marks)</p> <p>AO1 – Demonstrates clear knowledge and understanding of concepts, processes, interactions and change. These are mostly relevant though there may be some minor inaccuracy.</p> <p>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. A clear but partial argument is presented.</p> <p>Level 1 (1–3 marks)</p> <p>AO1 – Demonstrates basic knowledge and understanding of concepts, processes, interactions and change. This offers limited relevance with inaccuracy.</p> <p>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. A basic argument is presented.</p> <p>Notes for answers</p> <p>AO1</p> <ul style="list-style-type: none"> The principals of governance: The emergence and developing role of norms, laws and institutions in regulating and reproducing global 	<p>9</p> <p>AO1=4 AO2=5</p>
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	<p>systems.</p> <ul style="list-style-type: none"> • Issues associated with governance, including how agencies, can work to promote growth and stability. • Interactions between the local, regional, national, international and global scales are fundamental to understanding governance. • The nature of tropical rainforests to include: the main characteristics ecological responses to the climate, soil and soil moisture budget – adaptations by flora and fauna human activity and its impact on each biome. • Typical development issues in each biome to include changes in population, economic development, agricultural extension and intensification, implications for biodiversity and sustainability. <p>AO2</p> <ul style="list-style-type: none"> • Evaluation – For the equatorial rainforest there is likely to be a justification for the necessity of governance. This is likely to be focused upon the management of natural vegetation, habitat, soil and localised climate. • Evaluation – Should consider the work of agencies/organisations at any scale and specifically the effectiveness of the governance in achieving these defined aims eg: The Tropical Forest Alliance seeks to: Improve planning and management related to tropical forest conservation, agricultural land use and land tenure; share best practices for tropical forest and ecosystem conservation and commodity production, including working with smallholder farmers and other producers on sustainable agricultural intensification, promoting the use of degraded lands and reforestation; provide expertise and knowledge to assist with the development of commodity and processed-commodity markets that promote the conservation of tropical forests; improve monitoring of tropical deforestation and forest degradation to measure progress. • Evaluation – The best responses should offer detailed location support of actual evidence of good governance though a variety of schemes and overarching aims. <ol style="list-style-type: none"> 1. Creation of reservations free from development. 2. Eco-tourism and its potential to generate income and conserve landscapes. 3. Agricultural practices, eg The African Palm Oil Project. 4. Energy projects. 5. Afforestation projects. 6. Debt for land schemes. 	
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06	4	<p>Analyse the role of nutrient cycling within a hydrosere or lithosere that you have studied.</p> <p>AO1 – Knowledge and understanding of the nutrient cycle. Knowledge and understanding of seral stage development in a hydrosere or lithosere.</p> <p>AO2 – Application of knowledge and understanding to analyse how the nutrient cycle is an integral part of the development of the seral stages in a hydrosere or lithosere.</p> <p>Mark scheme</p> <p>AO1 – Demonstrates detailed knowledge and understanding of concepts, processes, interactions and change. These underpin the response throughout.</p> <p>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. A well balanced and coherent argument is presented.</p> <p>Level 2 (4–6 marks)</p> <p>AO1 – Demonstrates clear knowledge and understanding of concepts, processes, interactions and change. These are mostly relevant though there may be some minor inaccuracy.</p> <p>AO2 – Applies clear knowledge and understanding appropriately. Connections and relationships between different aspects of study are evident with some relevance. Analysis is supported with clear and appropriate evidence. A clear but partial argument is presented. A basic argument is presented.</p> <p>Level 1 (1–3 marks)</p> <p>AO1 – Demonstrates basic knowledge and understanding of concepts, processes, interactions and change. This offers limited relevance with inaccuracy.</p> <p>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.</p> <p>Notes for answers</p> <p>AO1</p> <ul style="list-style-type: none"> • Nature of ecosystems – their structure, energy flows, trophic levels, food chains and food webs. • Application of systems concepts to ecosystems – inputs, outputs, stores and transfers of energy and materials. Concepts of biomass and net primary production. 	<p>9</p> <p>AO1=4 AO2=5</p>
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	<ul style="list-style-type: none"> • Concepts of succession: seral stages, climatic climax, sub-climax and plagioclimax. • Mineral nutrient cycling. • Nature of terrestrial/marine 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. • Succession and climatic climax as illustrated by lithoseres and hydroseres. <p>AO2 For lithosere:</p> <ul style="list-style-type: none"> • Analysis – A lithosere (a sere originating on rock) is a plant succession that begins life on a newly exposed rock surface, such as one left bare as a result of glacial retreat, tectonic uplift as in the formation of a raised beach, or volcanic eruptions. Expect to see reference to a named example, the lava fields of Eldgjá in Iceland where Laki and Katla fissures erupted in the year 934 and the solidified lava has, over time, begun to form a lithosere. Pioneer species are the first organisms that colonise an area, of which lithoseres are an example. They will typically be very hardy, eg xerophytes. In the case of a lithosere the pioneer species which create their own food and water, ie they are autotrophic and so do not require any external nutrition (except sunlight). Other examples of lithoseres include communities of mosses and lichens. These are extremely resilient and are capable of surviving in areas without soil. There should be a clear link to the basic nutrients provided by the host bare rock which are then taken up by these species. • Analysis – As more mosses and lichens colonise the area, they, along with natural elements such as wind and frost shattering, begin to weather the rock down. This over time creates more soil, leading to increased water retention. The amount of soil is also increased by the decaying mosses and lichens. This is the contribution of the nutrient cycle to the seral stage development. Nutrients are released from the weathered rock but also from the decay of organic matter, which is broken down by detritivores. This improves the fertility of the soil as humus is increased, allowing grasses and ferns to colonise. With further decay and recycling of nutrients a soil structure emerges, which is also developed and aerated by the decomposers. Over time, flowering plants will emerge, followed by shrubs. As the soil gets progressively deeper, larger and more advanced plants are able to grow. • Analysis – As the plant succession develops further, trees start to appear. The first trees (or pioneer trees) that appear are typically fast growing trees such as birch, willow or rowan. In turn these will be replaced by slow growing, larger trees such as ash and oak (in temperate deciduous woodland). This is the climax community on a lithosere, defined as the point where a plant succession does not 	
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		<p>develop any further – it reaches a delicate equilibrium with the environment, in particular the climate. At this stage, the nutrient cycling is provided by leaf litter fall and decay as well as the death of the tree and release of nutrient through the decomposition of the wood and leaf litter.</p> <ul style="list-style-type: none"> • Analysis – Expect to see reference to named nutrients which are continuously recycled through the system in the seral stage development towards climatic climax. <p>For hydrosere:</p> <p>Expect to see reference to specific terminology such as seral stages, succession, pioneers and climatic climax. Named nutrients should feature as part of the natural cycle through to climatic climax within the hydrosere:</p> <ul style="list-style-type: none"> • Analysis – Insects such as pond skaters and water beetles would typically be the first species to arrive at an empty pond. They fly between ponds, bringing spores of other creatures such as diatoms and algae. Microscopic plant and animal material may also be blown in by the wind. Herons and ducks will visit the water in hope of food. In the process they may carry seeds of plants and eggs of animals. These will stick to the legs and feathers, especially if they have been treading in the mud of a well-established pond before arrival. If there is an inflow of water to the pond that will also bring in new organisms. As the temperature rises in late spring to early summer, algae will quickly begin to grow and the surface covering over with blanket weed. This will give some shelter and refuge to the insects that have migrated here. The diatoms multiply and begin to bloom. The process of immigration continually brings in new species that, if they like the conditions, will stay and begin the process of multiplication. This will lead to a community of plants and animals establishing. • As plants and animals die and decay the cycling of nutrients will begin. • Plants like frogbit or rooted ones like lillies take over the deeper water. They provide shelter for animals and begin to change the abiotic conditions like reducing the effect of the wind on the surface. Each year dead organic matter produced by these plants begin to accumulate at the bottom. In time this makes the pond shallow and reedmace, sedges and rushes start to take root, taking advantage of the nutrients released as a result of the process of decomposition. The development of the hydrosere is completely dependent upon the cycling of nutrients such as carbon nitrogen and phosphorous. • Some responses may go further and analyse the role of different types of nutrient in the growth process. • Young trees like alder and willow may be developing and competing with the reeds. Many of the sedges are quite small and will have been out-competed already. With the reduction in the variety of plant communities the variety of animals decline. The pond diversity diminishes as trees develop a canopy which will 	
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		<p>eradicate many of the plants.</p> <ul style="list-style-type: none"> • Analysis – As with lithosere development, at this stage, the nutrient cycling is provided by leaf litter fall and decay as well as the death of the tree and release of nutrient through the decomposition of the wood and leaf litter. 	
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06	5	<p>‘It is impossible to achieve economic development within marine ecosystems whilst adhering to the principals of sustainability.’</p> <p>To what extent do you agree with this view?</p> <p>AO1 – Knowledge and understanding of a range of economic activities taking place in marine ecosystems. Knowledge and understanding of the concept of sustainability in marine ecosystems.</p> <p>AO2 – Application of knowledge and understanding to evaluate the challenge and conflict associated with achieving both economic development and sustainability in marine ecosystems. There should be some analysis and evaluation of the extent to which the statement is valid.</p> <p>Notes for answers</p> <p>AO1</p> <ul style="list-style-type: none"> • The concept of biodiversity. Local and global trends in biodiversity. Causes, rates and potential impacts of declining biodiversity. These concepts should be specifically adapted to marine ecosystems. The role of human activity in reducing / negatively impacting upon marine biodiversity is likely to be a feature • Ecosystems and their importance for human populations in the light of continuing population growth and economic development. Human populations in ecosystem development and sustainability. This should be specifically related to marine ecosystems. The role of human activity in exploiting marine ecosystems for economic or subsistence gain. • Factors influencing the changing of ecosystems, including climate change and human exploitation of the global environment. This should be specifically related to marine ecosystems. There should be consideration of the extent to which marine ecosystems have become increasingly vulnerable and fragile as a result of human activity and climate change. • Ecosystem responses to changes in one or more of their components or environmental controls. This should consider the ecological response i.e. the impact of climate change and economic exploitation of marine ecosystems. • Typical development issues in marine ecosystems to include changes in population, economic development, implications for biodiversity and sustainability. This is likely to focus upon fishing and tourism as two of the major threats to the marine ecosystem. 	<p>20</p> <p>AO1=10 AO2=10</p>
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	<ul style="list-style-type: none"> • The distribution and main characteristics of coral reef ecosystems. Environmental conditions associated with reef development. This may form part of an introduction to highlight the background as well as helping to identify geographical locations of areas under particular threat. • Factors in the health and survival of reefs: <ol style="list-style-type: none"> 1. Natural: Water temperature, acidity, salinity, algal blooms. 2. Human activity and its impact: Major drainage basin schemes, onshore development, desalination, pollution, tourism, fishing. 3. Future prospects for coral reefs with reference to named case studies. <p>AO2</p> <ul style="list-style-type: none"> • Evaluation – Responses may start with definitions of sustainability or sustainable development. This may involve evaluation of the inherent conflict associated with economic development and sustainable development. In this sense, economic development requires some form of exploitation of the environment and/or its natural resources. Sustainable development is concerned with conserving the environment and natural resources (without depletion) so that future generations experience no significant deterioration in access to those resources and associated quality of life. This would constitute a more sophisticated awareness of the demands of the question. • Analysis and evaluation – expect analysis to consider a range of human activity aimed at economic development in marine ecosystems. Evaluation should consider the impact of this economic development and whether it could be considered sustainable. For example: • Analysis and evaluation of the impact of different types of Fishing, including dynamite fishing and collecting tropical fish for aquariums or human consumption. These actions can result in shifts in species size and composition in the reefs, decreasing the biodiversity and coral cover and endangering the future of the impacted reefs. Current practices, many will argue are unsustainable. This could be exemplified eg One issue is the capture of live fish to be put in aquariums or served in specialty restaurants. Fish are caught live in Indo-Pacific countries like the Philippines because they can fetch a much higher price. This particularly affects the 'grouper' species as they are very popular in restaurants in East Asia. It has been calculated that the live reef food business in East Asia is worth over \$1 billion. Clearly this would be considered as unsustainable practice despite providing substantial economic potential. Catching juvenile fish has a serious impact upon the reproductive profile of the population. Others may consider the impact of cyanide or dynamite fishing with its associated negative impact upon the reef health including coral and bleaching and destruction. There may also be consideration of the impact of trawler fishing and dredging, none of which are considered sustainable. 	
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	<ul style="list-style-type: none"> • Analysis and evaluation of more sustainable economic development may also be undertaken. The reason for this approach is show that there are more sustainable solutions which still allow for the needs of locals to be met whilst conserving these marine ecosystems for future generations. This is likely to focus upon education around development of tourism as an alternative income generator: <ol style="list-style-type: none"> 1. Mooring buoys protect the reefs from anchoring. Educational programs for boat divers, tour guides and tourists about reef maintenance and protection. 2. Implementing regular beach and reef clean-ups, removing potentially polluting debris. 3. Eradicating destructive fishing by setting up educational outreach programs and co-operative patrols between local government, central government and the fishermen. 4. Development of sustainable projects that will provide the community with income. 5. Setting up school educational programs about reef conservation and waste management. 	
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Marking grid for Question 6.5

Level/ Mark Range	Criteria/Descriptor
Level 4 (16–20 marks)	<ul style="list-style-type: none"> • 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)	<ul style="list-style-type: none"> • 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)	<ul style="list-style-type: none"> • 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)	<ul style="list-style-type: none"> • 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).

	<ul style="list-style-type: none"> • 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)	<ul style="list-style-type: none"> • Nothing worthy of credit.

