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# A-LEVEL Geography

7037/1 – Paper 1 – Physical Geography

Mark scheme

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7037

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Version/Stage: 1.0 Final

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

## Explanation of annotations

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

## Section A

## Question 1 Water and carbon cycles

Qu	Part	Marking guidance	Total marks
01	1	<p><b>Explain the role of cryospheric change in the water cycle.</b></p> <p>Allow 1 mark per valid point with extra mark(s) for developed points (d).</p> <p><b>AO1 –</b></p> <ul style="list-style-type: none"> <li>• Cryospheric change has a regulatory role in sea levels (1).</li> <li>• The cryosphere is a major store of water (1).</li> <li>• In a period of cooling (glacial period) the cryosphere will grow in size (1). This is because the water cycle is slowed considerably as the ice restricts the return of the water to the sea and ocean (d).</li> <li>• In a period of warming the cryosphere will add water to the cycle (1). As the water cycle restarts more of the ice melts and returns water to the sea (d).</li> <li>• This increased the size of ocean store causing sea levels to rise through increased volumes of water (1) and thermal expansion (d).</li> <li>• Consideration of changes in permafrost is also valid (1).</li> </ul> <p>No additional credit for straight reversals.</p>	4 <b>AO1=4</b>
01	2	<p><b>Analyse the data shown in Figure 1.</b></p> <p><b>AO3 –</b> There should be detailed analysis of the overarching patterns which shows awareness of the main contributors to greenhouse gas emissions. More sophisticated responses will analyse the detailed differences in countries of varying levels of development.</p> <p><u>Mark scheme</u></p> <p><b>Level 2 (4 – 6 marks)</b></p> <p><b>AO3 –</b> 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><b>Level 1 (1 – 3 marks)</b></p> <p><b>AO3 –</b> 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>	6 <b>AO3=6</b>

		<p><u>Notes for answers</u></p> <p><b>AO3</b></p> <p>Level 1 responses are likely to simply describe the data without clear attempt to analyse, for instance by manipulating data or spotting trends.</p> <ul style="list-style-type: none"> <li>• <b>Figure 1</b> shows that high income countries are still the biggest contributors to GHG production but that there has been little growth between 1990 and 2010 in particular (0.4 Gigatonnes of CO<sub>2</sub>).</li> <li>• It is upper-middle income countries which have seen the fastest rates of growth of the time periods. For instance, there has been an almost doubling from 98 to 18.3 gigatonnes of CO<sub>2</sub> produced. Industry appears to have more than doubled in its contribution to GHG in this group of countries (from approximately 2 to around 5 gigatonnes).</li> <li>• Low and low-middle income countries contribute relatively little to the overall GHG emissions. For instance, combined in 2010 they produced only 11.3 gigatonnes, 7.4 gigatonnes less than high income countries. These countries greatest contribution comes through agriculture (especially for low income countries) with very little through energy use and transport.</li> <li>• Some may conclude that the poorest countries in the world are largely not responsible for the vast majority of the GHG emissions and that this contribution, if anything, is shrinking.</li> </ul>	
01	3	<p><b>Using Figure 2 and your own knowledge, assess the challenges associated with reducing greenhouse gas emissions.</b></p> <p><b>AO1</b> – The carbon budget and the impact of the carbon cycle upon land, ocean and atmosphere, including global climate. Human interventions in the carbon cycle designed to influence carbon transfers and mitigate the impacts of climate change.</p> <p><b>AO2</b> – Application of knowledge to show an understanding of the challenges associated with managing climate change including emissions reductions.</p> <p><u>Mark scheme</u></p> <p><b>Level 2</b> (4 – 6 marks)</p> <p><b>AO1</b> – Demonstrates clear knowledge and understanding of concepts, processes, interactions and change.</p> <p><b>AO2</b> – Applies knowledge and understanding to the novel situation offering clear evaluation and analysis drawn appropriately from the context provided. Connections and relationships between different aspects of study are evident with clear relevance.</p>	<p>6</p> <p><b>AO1=2</b> <b>AO2=4</b></p>

	<p><b>Level 1</b> (1 – 3 marks)</p> <p><b>AO1</b> – Demonstrates basic knowledge and understanding of concepts, processes, interactions, change.</p> <p><b>AO2</b> – Applies limited knowledge and understanding to the novel situation offering only basic evaluation and analysis drawn from the context provided. Connections and relationships between different aspects of study are basic with limited relevance.</p> <p><u>Notes for answers</u></p> <p><b>AO1</b></p> <ul style="list-style-type: none"> <li>• Changes in the carbon cycle over time, human impact (including hydrocarbon fuel extraction and burning, farming practices, deforestation, land use changes).</li> <li>• The carbon budget and the impact of the carbon cycle upon land, ocean and atmosphere, including global climate.</li> <li>• Human interventions in the carbon cycle designed to influence carbon transfers and mitigate the impacts of climate change.</li> <li>• Factors driving change the carbon cycle - combustion.</li> </ul> <p><b>AO2</b></p> <ul style="list-style-type: none"> <li>• The challenge has been around obtaining agreement in what is clearly not an equal situation. The richest countries, such as some in Europe and the USA, make a disproportionately high contribution to global warming. This is combined with the fact that USA has sought to pull out of the Paris agreement.</li> <li>• If the USA or China pulled out of the agreement, the whole agreement is at risk. Many countries make little or no contribution to the global climate change and yet they are signatories. Canada and most African countries contribute very little to global climate change yet most are signatories to the Paris Agreement.</li> <li>• For most countries, economic development is synonymous with increased carbon emissions. Restricting emissions to achieve a climate of below 2°C is likely to harm many developing economies. If USA were to pull out this would inevitably raise questions of fairness and place national pressure on sovereign governments to make the same decision.</li> <li>• Some may argue that USA stands to gain comparative advantage. By pulling out of the Paris Agreement, the commitment to green energy production schemes and carbon emissions reduction strategies (as part of the Paris Agreement) are also likely to be dispensed with. This is likely to relieve the burden of substantial economic cost upon the USA. In this sense the biggest polluter will continue to gain economic advantage from burning fossil with none of the costs and arguably responsibility for mitigation.</li> </ul>	
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01	4	<p><b>Assess the potential causes and impacts of changes to the water balance within a tropical rainforest that you have studied.</b></p> <p><b>AO1</b> – An awareness of factors leading to change in the water cycle over time. Knowledge and understanding of the chosen tropical rainforest case study.</p> <p><b>AO2</b> – Application of knowledge and understanding to assess the human and physical causes and impacts of changes to the water cycle in tropical rainforests.</p> <p><u>Notes for answers</u></p> <p><b>AO1</b></p> <ul style="list-style-type: none"> <li>• Processes driving change in the magnitude of water storage over time and space, including flows and transfers: evaporation, condensation, cloud formation, causes of precipitation, drainage basin and global scales with reference to varying timescales involved.</li> <li>• Drainage basins as open systems – inputs and outputs, to include precipitation, evapotranspiration and 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.</li> <li>• Changes in the water cycle over time to include natural variation including storm events, seasonal changes and human impact including farming practices, land use change and water abstraction.</li> <li>• The key role of the carbon and water stores and cycles in supporting life on Earth with particular reference to climate. The relationship between the water cycle and carbon cycle in the atmosphere.</li> <li>• The role of feedbacks within and between cycles and their link to climate change and implications for life on Earth.</li> <li>• Use of 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.</li> </ul> <p><b>AO2</b></p> <ul style="list-style-type: none"> <li>• In terms of causes, most are likely to refer to changes in the water cycle as an indirect consequence of human activity. Expect to see reference to a range of human activities such as: <ul style="list-style-type: none"> <li>• agricultural practices which lead to soil compaction increasing surface runoff.</li> <li>• Deforestation which reduces evapotranspiration, removes top soil thus infiltration and throughflow.</li> <li>• Mining which leads to large scale vegetation clearance which again reduces evapotranspiration and convection rainfall.</li> </ul> </li> <li>• Some may consider the potential role of climate change and its impact upon the water balance in tropical rainforests.</li> </ul>	<p>20</p> <p><b>AO1=10</b> <b>AO2=10</b></p>
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		<ul style="list-style-type: none"><li>• Impacts may be considered in the local and regional contexts:</li><li>• Locally the removal of vegetation and soil compaction combine to lead to increased likelihood of flood. Rivers have reduced capacity due the effect of sediment transfer to the river bed. There is also increased runoff and a lack of uptake of water through vegetation.</li><li>• Regionally some may refer to the risk of reduced convectional rainfall as a result of the loss of water in the system and the breakdown of the convection cycle. Some may refer to a reduction in the regional precipitation rates caused increased temperatures, rates of evaporation and a disruption to the regional weather systems in the affected area. There may be a link to changes in the carbon cycle at this point. This is acceptable as long as it does not lead to drift away from the theme of the question.</li><li>• Regionally some may argue that there is expected to be an overall decrease in the discharge of rivers in tropical rainforests as a result of the fall in overall precipitation levels.</li><li>• Support should be offered through a named tropical rainforest. Expect Amazonia, central Africa and south-east Asia to feature.</li><li>• Some sense of the nature/character of the place concerned may be conveyed.</li></ul> <p>There should be some explicit overarching assessment based upon preceding content.</p>	
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**Marking grid for Question 1.4**

<b>Level/ Mark Range</b>	<b>Criteria/Descriptor</b>
<b>Level 4 (16–20 marks)</b>	<ul style="list-style-type: none"> <li>• Detailed evaluative conclusion that is rational and firmly based on knowledge and understanding which is applied to the context of the question. Interpretations are comprehensive, sound and coherent (AO2).</li> <li>• Detailed, coherent and relevant analysis and evaluation in the application of knowledge and understanding throughout (AO2).</li> <li>• Full evidence of links between knowledge and understanding to the application of knowledge and understanding in different contexts (AO2).</li> <li>• Detailed, highly relevant and appropriate knowledge and understanding of place(s) and environments used throughout (AO1).</li> <li>• Full and accurate knowledge and understanding of key concepts, processes and interactions and change throughout (AO1).</li> </ul>
<b>Level 3 (11–15 marks)</b>	<ul style="list-style-type: none"> <li>• Clear evaluative conclusion that is based on knowledge and understanding which is applied to the context of the question. Interpretations are generally clear and support the response in most aspects (AO2).</li> <li>• Generally clear, coherent and relevant analysis and evaluation in the application of knowledge and understanding (AO2).</li> <li>• Generally clear evidence of links between knowledge and understanding to the application of knowledge and understanding in different contexts (AO2).</li> <li>• Generally clear and relevant knowledge and understanding of place(s) and environments (AO1).</li> <li>• Generally clear and accurate knowledge and understanding of key concepts, processes and interactions and change (AO1).</li> </ul>
<b>Level 2 (6–10 marks)</b>	<ul style="list-style-type: none"> <li>• Some sense of an evaluative conclusion partially based upon knowledge and understanding which is applied to the context of the question (AO2). Interpretations are partial but do support the response in places.</li> <li>• Some partially relevant analysis and evaluation in the application of knowledge and understanding (AO2).</li> <li>• Some evidence of links between knowledge and understanding to the application of knowledge and understanding in different contexts (AO2).</li> <li>• Some relevant knowledge and understanding of place(s) and environments which is partially relevant (AO1).</li> <li>• Some knowledge and understanding of key concepts, processes and interactions and change. There may be a few inaccuracies (AO1).</li> </ul>
<b>Level 1 (1–5 marks)</b>	<ul style="list-style-type: none"> <li>• Very limited and/or unsupported evaluative conclusion that is loosely based upon knowledge and understanding which is applied to the context of the question. Interpretation is basic (AO2).</li> <li>• Very limited analysis and evaluation in the application of knowledge and understanding. This lacks clarity and coherence (AO2).</li> <li>• Very limited and rarely logical evidence of links between knowledge and understanding to the application of knowledge and understanding in different contexts (AO2).</li> <li>• Very limited relevant knowledge and understanding of place(s) and environments (AO1).</li> <li>• Isolated knowledge and understanding of key concepts, processes and interactions and change. There may be a number of inaccuracies. (AO1).</li> </ul>

<b>Level 0 (0 marks)</b>	<ul style="list-style-type: none"><li>• Nothing worthy of credit.</li></ul>
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## Section B

## Question 2 Hot desert systems and landscapes

Qu	Part	Marking guidance	Total marks
02	1	<p><b>Outline the role of atmospheric processes in causing aridity in hot desert regions.</b></p> <p>Allow one mark per valid point with extra mark(s) for developed points (d).</p> <p><b>AO1 –</b></p> <ul style="list-style-type: none"> <li>• Deserts are generally located in sub-tropical; areas of high pressure (1). Some may reference the tri cellular model and the convergence of the Hadley cell and the Ferrel cell (1).</li> <li>• Warm descending dry air leads to evaporation and cloudless skies (1).</li> <li>• The high pressure forces warm dry to dominate the regions; any moist air is effectively kept out by the high pressure (1).</li> <li>• Some may refer to the atmospheric changes brought about by continentality, that moist coastal air will lose this moisture further inland leading to dry conditions (1).</li> <li>• Some may consider the rain shadow effect of relief in desert regions (1 +1 with development).</li> <li>• Ocean currents may also feature in the cause of aridity, but there has to a clear link to reduced capacity of the air to pick up moisture (1 + 1 with development).</li> </ul>	4 <b>AO1=4</b>
02	2	<p><b>Analyse the data shown in Figure 3.</b></p> <p><b>AO3 –</b> Responses should use the resource effectively and appropriately showing understanding of the graph and its complexity of potential inter-relationships. Expect to see analysis of patterns and identification of potential anomalies. There should be use of data in support.</p> <p><u>Mark scheme</u></p> <p><b>Level 2 (4 – 6 marks)</b></p> <p><b>AO3 –</b> 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><b>Level 1 (1 – 3 marks)</b></p> <p><b>AO3 –</b> 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><u>Notes for answers</u></p>	6 <b>AO3=6</b>

		<p><b>AO3</b></p> <ul style="list-style-type: none"> <li>• The population is rising against a backdrop of considerable precipitation variability. This variability appears to be increasing in more recent times. From around 1970 there appears to have been a shift in the rainfall index from mainly positive to mainly negative indicating lower than average rainfall in successive years. These peak at -1.5 around 1990. Despite this, the population continues to rise and, if anything, from around 1985 to 1990 that rate appears to marginally increase. From this information it is reasonable to conclude that the population growth rate is not affected by the precipitation in the area, at least not in this timescale.</li> <li>• The data for drought appears somewhat unclear. Not all drought follows a period of below average rainfall. Around 1905 there appears to be a prolonged period with significantly below average rainfall (up to -1.6) and this does correlate with a period of drought. However, the drought in 1941 and 1975-77 appears to follow periods where the rainfall totals were normal. This suggests some other factors may be leading to the drought conditions.</li> <li>• Famine almost always correlates with periods of drought, though locust outbreaks also correlate with three periods of drought. It is reasonable to assume that drought leads to poor harvest so these locust outbreaks appear unconnected.</li> <li>• There is one anomaly in 1952 where there is no drought but there is famine. This again suggests other factors may have been at play here.</li> <li>• Some may suggest the famine in 1930 may have been connected to the locust outbreak as there was no drought at this time.</li> <li>• The uprisings do not appear to be connected to environmental conditions or population growth. The uprising around 1900 followed a period of above average rainfall of example and came at a time when population was much lower.</li> </ul>	
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02	3	<p><b>Using Figure 4 and your own knowledge, assess the view that wind is the most important factor in the development of this landscape.</b></p> <p><b>AO1</b> – Knowledge and understanding of the factors leading to the formation of formation of yardangs.</p> <p><b>AO2</b> – Application of knowledge and understanding to understanding of how weathering, the role of wind and differential erosion have contributed to the development of this landscape.</p> <p><u>Mark scheme</u></p>	<p>6</p> <p><b>AO1=2</b> <b>AO2=4</b></p>
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	<p><b>Level 2 (4 – 6 marks)</b></p> <p><b>AO1</b> – Demonstrates clear knowledge and understanding of concepts, processes, interactions and change.</p> <p><b>AO2</b> – Applies knowledge and understanding to the novel situation offering clear evaluation and analysis drawn appropriately from the context provided. Connections and relationships between different aspects of study are evident with clear relevance.</p> <p><b>Level 1 (1 – 3 marks)</b></p> <p><b>AO1</b> – Demonstrates basic knowledge and understanding of concepts, processes, interactions and change.</p> <p><b>AO2</b> – Applies limited knowledge and understanding to the novel situation offering only basic evaluation and analysis drawn from the context provided. Connections and relationships between different aspects of study are basic with limited relevance.</p> <p><u>Notes for answers</u></p> <p><b>AO1</b></p> <ul style="list-style-type: none"> <li>• Sources of energy in hot desert environments: insolation, winds, runoff.</li> <li>• Sediment sources, cells and budgets.</li> <li>• Geomorphological processes: weathering, mass movement, erosion, transportation and deposition.</li> <li>• Distinctively arid geomorphological processes: weathering (thermal fracture, exfoliation, chemical weathering, block and granular disintegration).</li> <li>• The role of wind – erosion: deflation and abrasion; transportation; suspension, saltation, surface creep, deposition.</li> <li>• Sources of water: exogenous, endoreic and ephemeral; the episodic role of water; sheet flooding.</li> <li>• Origin and development of landforms of mid and low latitude deserts: aeolian yardangs.</li> </ul> <p><b>AO2</b></p> <ul style="list-style-type: none"> <li>• The information suggests that the rock was consolidated towards the end of the last ice age. These features are likely to have developed over thousands of years.</li> <li>• Aeolian erosion has without doubt contributed to the development of the yardangs. As wind picks up fine sediments, these act as a tool of abrasion, scouring the rock in between the yardangs.</li> <li>• Wind is also likely to account for the alignment of the yardangs; they are most likely aligned to the direction of the prevailing wind.</li> <li>• There is also evidence of scouring along horizontal bedding planes.</li> <li>• Some may suggest that it is not only wind which is responsible for the formation of these landscapes. The geology is a contributory</li> </ul>	
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		<p>factor. Reference may be made to differences in the local geology as a result of the sediments laid down at the end of the ice age.</p> <ul style="list-style-type: none"> <li>• Others may refer to the role of weathering processes, specifically those related to extreme temperature variation.</li> <li>• The vertical cracks in the yardangs may even be a product of the role of periodic presence of water and water may have contributed to the development of the troughs in between the yardangs, particularly if the climate allowed for the development of ephemeral water. This is a reasonable argument. However, the presence of the layer of what looks like fine sands suggests water is no longer a feature in the development of this landscape.</li> </ul> <p>Generic explanation of the formation of yardangs (with no attempt to apply knowledge to the image and associated information) should be held to Level 1.</p>	
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02	4	<p><b>‘Climate change is on course to radically alter the role of water in deserts and their margins, affecting both human populations and the physical landscape.’</b></p> <p><b>To what extent do you agree with this view?</b></p> <p><b>AO1</b></p> <ul style="list-style-type: none"> <li>• Knowledge and understanding of the impact of climate change upon arid and semi-arid landscapes.</li> </ul> <p><b>AO2</b></p> <ul style="list-style-type: none"> <li>• Application of knowledge and understanding to examine the extent to which climate change is set to affect populations in arid environments and also landscape development.</li> </ul> <p><u>Notes for answers</u></p> <p><b>AO1</b></p> <ul style="list-style-type: none"> <li>• Systems in physical geography: systems concepts and their application to the development of desert landscapes – inputs, outputs, energy, stores/components, flows/transfers, positive/negative feedback, dynamic equilibrium. The concepts of landform and landscape and how related landforms combine to form characteristic landscapes.</li> <li>• The global distribution of mid and low latitude deserts and their margins (arid and semi-arid).</li> <li>• Characteristics of hot desert environments and their margins: climate, soils and vegetation (and their interaction). Water balance and aridity index.</li> <li>• Sources of water: exogenous, endoreic and ephemeral; the episodic role of water; sheet flooding, channel flash flooding.</li> <li>• Origin and development of landforms of mid and low latitude deserts: water – wadis, bahadas, pediments, playas, inselbergs.</li> <li>• The changing extent and distribution of hot deserts over the last 10,000 years. The causes of desertification – climate change and</li> </ul>	<p>20</p> <p><b>AO1=10</b> <b>AO2=10</b></p>
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		<p>human impact; distribution of areas at risk; impact on ecosystems, landscapes and populations. Predicted climate change and its impacts; alternative possible futures for local populations.</p> <ul style="list-style-type: none"> <li>• Case study at a local scale of a landscape where desertification has occurred to illustrate and analyse key themes of desertification, causes and impacts, implications for sustainable development. Evaluation of human responses of resilience, mitigation and adaptation.</li> </ul> <p><b>AO2</b></p> <ul style="list-style-type: none"> <li>• Climate change is set to cause a number of significant impacts upon desert regions. The higher temperatures (as much as 5°C) will increase evaporation rates, further reducing any surface storage as well as impacting upon all sources of water.</li> <li>• There is likely to be less ephemeral, endoreic and exogenous water supplied. This will in turn impact upon groundwater storage. In essence, all sources of water are expected to diminish.</li> <li>• The increased atmospheric CO<sub>2</sub> will also create potential imbalances in desert ecosystems. This may promote the development of some species in wetter periods, radically altering the local ecosystem, affecting both habitats as well as ecological niches.</li> <li>• Desertification will almost certainly spread at desert margins, especially when combined with the impact of population pressures. Some may counterbalance this with measures to address the challenges of desertification through local small-scale water management schemes.</li> <li>• The impact of desertification on crop yields, pastoral farming and availability of fuelwood is likely to feature. This will be more effective if strongly rooted in place.</li> <li>• Soil erosion is likely to be linked to changes in the water balance. As evaporation exceeds precipitation for longer periods, the soil dries out rendering it useless for cultivation and also uptake by natural vegetation. Some may also link this to the development and expansion of salt pans.</li> <li>• Slow growing trees and shrubs which are uniquely adapted may die out and be replaced by faster growing and more resilient grasses. However, these species are more readily affected by wildfire.</li> <li>• In the physical landscape, the lack of vegetation will lead to increased rates of wind erosion. Some may link this to increased development of deflation hollows as well as landforms of erosion associated with wind.</li> <li>• Moreover, the lack of water will mean ephemeral streams and rivers dry up. Wadis and bahadas may lose water supply and themselves become subject to wind erosion.</li> <li>• Some may argue that flash flooding is set to become more common as a result of climate change, leading to short term highly erosive ephemeral rivers and further erosion as a result of surface runoff.</li> </ul>	
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	<p>Whatever the approach there should be consideration of impact upon people and the physical landscape.</p> <p>There should also be a view expressed in relation to the question.</p>	
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**Marking grid for Question 2.4**

<b>Level/ Mark Range</b>	<b>Criteria/Descriptor</b>
<b>Level 4 (16–20 marks)</b>	<ul style="list-style-type: none"> <li>• Detailed evaluative conclusion that is rational and firmly based on knowledge and understanding which is applied to the context of the question. Interpretations are comprehensive, sound and coherent (AO2).</li> <li>• Detailed, coherent and relevant analysis and evaluation in the application of knowledge and understanding throughout (AO2).</li> <li>• Full evidence of links between knowledge and understanding to the application of knowledge and understanding in different contexts (AO2).</li> <li>• Detailed, highly relevant and appropriate knowledge and understanding of place(s) and environments used throughout (AO1).</li> <li>• Full and accurate knowledge and understanding of key concepts, processes and interactions and change throughout (AO1).</li> </ul>
<b>Level 3 (11–15 marks)</b>	<ul style="list-style-type: none"> <li>• Clear evaluative conclusion that is based on knowledge and understanding which is applied to the context of the question. Interpretations are generally clear and support the response in most aspects (AO2).</li> <li>• Generally clear, coherent and relevant analysis and evaluation in the application of knowledge and understanding (AO2).</li> <li>• Generally clear evidence of links between knowledge and understanding to the application of knowledge and understanding in different contexts (AO2).</li> <li>• Generally clear and relevant knowledge and understanding of place(s) and environments (AO1).</li> <li>• Generally clear and accurate knowledge and understanding of key concepts, processes and interactions and change (AO1).</li> </ul>
<b>Level 2 (6–10 marks)</b>	<ul style="list-style-type: none"> <li>• Some sense of an evaluative conclusion partially based upon knowledge and understanding which is applied to the context of the question (AO2). Interpretations are partial but do support the response in places.</li> <li>• Some partially relevant analysis and evaluation in the application of knowledge and understanding (AO2).</li> <li>• Some evidence of links between knowledge and understanding to the application of knowledge and understanding in different contexts (AO2).</li> <li>• Some relevant knowledge and understanding of place(s) and environments which is partially relevant (AO1).</li> <li>• Some knowledge and understanding of key concepts, processes and interactions and change. There may be a few inaccuracies (AO1).</li> </ul>

<b>Level 1 (1–5 marks)</b>	<ul style="list-style-type: none"> <li>• 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). Interpretation is basic.</li> <li>• Very limited analysis and evaluation in the application of knowledge and understanding. This lacks clarity and coherence (AO2).</li> <li>• Very limited and rarely logical evidence of links between knowledge and understanding to the application of knowledge and understanding in different contexts (AO2).</li> <li>• Very limited relevant knowledge and understanding of place(s) and environments (AO1).</li> <li>• Isolated knowledge and understanding of key concepts, processes and interactions and change. There may be a number of inaccuracies. (AO1).</li> </ul>
<b>Level 0 (0 marks)</b>	<ul style="list-style-type: none"> <li>• Nothing worthy of credit.</li> </ul>

**Question 3 Coastal systems and landscapes**

<b>Qu</b>	<b>Part</b>	<b>Marking guidance</b>	<b>Total marks</b>
03	1	<p><b>Outline the processes which lead to the development of barrier beaches.</b></p> <p>Allow 1 mark per valid point with extra mark(s) for developed points (d).</p> <p><b>AO1 –</b></p> <ul style="list-style-type: none"> <li>• A barrier beach is usually formed as an extension to a spit (1).</li> <li>• Longshore drift moves sediment along the coastline until there is a change in the coastline (1). A spit develops, usually in a bay and once the spit develops across the whole bay, a barrier beach forms (1). Barrier beaches are unlikely to form in estuaries as the outcoming force of freshwater will always keep part of the estuary clear (1).</li> <li>• Colonisation by vegetation can stabilise the barrier beach and trap further sediment keeping the barrier beach above sea even at high tide (1).</li> <li>• Depending upon the climate the landward side may be colonised by mangroves in the still lagoon, which adds further stability (1).</li> </ul>	<p>4</p> <p><b>AO1=4</b></p>
03	2	<p><b>Analyse the data shown in Figure 5.</b></p> <p><b>AO3 –</b></p> <p>Analysis of the map evidence to show understanding of sediment transport around this sediment cell.</p>	<p>6</p> <p><b>AO3=6</b></p>

	<p><u>Mark scheme</u></p> <p><b>Level 2</b> (4 – 6 marks)</p> <p><b>AO3</b> – 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><b>Level 1</b> (1 – 3 marks)</p> <p><b>AO3</b> – 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><u>Notes for answers</u></p> <ul style="list-style-type: none"> <li>• This is a coastline which is being affected by longshore drift. The sediment cell is approximately 50-60 km long and the longshore current is moving sediment from east to west. The dominant wave direction is north, north-west. It suggests that waves must be hitting the coastline at a slight angle moving the sediment in a westerly direction.</li> <li>• There appears to be no coastal protection in place and significant quantities of material are being moved annually - 70,000 m<sup>3</sup> from the eastern end of the littoral cell. This suggests that erosion should be occurring at the eastern end as there is no apparent sediment input from rivers or from further along the eastern edge of the coastline.</li> <li>• The sediments appear to be being moving in an anti-clockwise direction around the bay. There is a significant input of sediment (240,000 m<sup>3</sup>) into the bay presumably as a result of river deposition. This continues to be circulated around the bay in an anti-clockwise direction. The river itself may be causing erosion in the bay. There is a zone of erosion at the point where the river meets the bay and just a little further east there is a zone of deposition.</li> <li>• Significant quantities of material appear to be lost to wind erosion as the sediment is blown inland. This is occurring in the north-west of Chabahar Bay.</li> <li>• Overall the bay is experiencing significantly more deposition than erosion due the contribution of longshore transported material and the input from the river.</li> </ul>	
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03	3	<p><b>Using Figure 6a, Figure 6b and your own knowledge, assess the potential impact of these changes on coastal landform development in this area.</b></p> <p><b>AO1</b> – Knowledge and understanding of the landforms associated with submergence and emergence.</p> <p><b>AO2</b> – Application of this knowledge to the novel situation; specifically, in accounting for the formation of landforms of submergence where the coastline has retreated. Landforms of submergence may be considered where candidates may infer localised isostatic readjustment has occurred.</p> <p><u>Mark scheme</u></p> <p><b>Level 2</b> (4 – 6 marks)</p> <p><b>AO1</b> – Demonstrates clear knowledge and understanding of concepts, processes, interactions and change.</p> <p><b>AO2</b> – Applies knowledge and understanding to the novel situation offering clear evaluation and analysis drawn appropriately from the context provided. Connections and relationships between different aspects of study are evident with clear relevance.</p> <p><b>Level 1</b> (1 – 3 marks)</p> <p><b>AO1</b> – Demonstrates basic knowledge and understanding of concepts, processes, interactions, change.</p> <p><b>AO2</b> – Applies limited knowledge and understanding to the novel situation offering only basic evaluation and analysis drawn from the context provided. Connections and relationships between different aspects of study are basic with limited relevance.</p> <p><u>Notes for answers</u></p> <p><b>AO1</b></p> <ul style="list-style-type: none"> <li>• Eustatic, isostatic and tectonic sea level change: major changes in sea level in the last 10,000 years.</li> <li>• Coastlines of emergence and submergence. Origin and development of associated landforms: raised beaches, marine platforms; rias, fjords, Dalmatian coasts.</li> <li>• Recent and predicted climatic change and potential impact on coasts.</li> <li>• The relationship between process, time, landforms and landscapes in coastal settings.</li> </ul> <p><b>AO2</b></p> <ul style="list-style-type: none"> <li>• <b>Figure 6a</b> shows that 20,000 years ago ice covered much of the north of Europe and northern Asia. It also affected the north of Britain and Ireland. Correspondingly sea levels appeared to be</li> </ul>	<p>6</p> <p><b>AO1=2</b> <b>AO2=4</b></p>
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		<p>much lower creating large swathes of land (for instance across what is currently the North Sea), which no longer exist today. <b>Figure 6b</b> shows that this land is now submerged. The land bridge connecting the UK to Ireland and mainland Europe has now been submerged.</p> <ul style="list-style-type: none"> <li>• This basic summary should then lead candidates to consider the landforms and landscapes associated with sea level change. Expect to see reference to drowned glacial troughs (Fjords) in northern Europe. Some description of process leading to formation is likely. Rias or drowned river valleys may also feature as well as dalmation coastlines.</li> <li>• More sophisticated responses may consider the localised isostatic readjustments which occurred following the end of the last glacial period. This should be accompanied with reference to raised beaches or marine platforms.</li> </ul> <p>Generic explanation of the formation of landforms of emergence and submergence (with no attempt to apply knowledge to the map and associated information) should be held to <b>Level 1</b>.</p>	
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03	4	<p><b>Assess the relative importance of weathering and erosion in the development of coastal landscapes.</b></p> <p><b>AO1</b> – Knowledge and understanding of the processes associated with weathering and erosion. Knowledge and understanding of the role of these processes in landscape development.</p> <p><b>AO2</b> – Application of knowledge and understanding to assess the relative importance of these processes in different contexts; specifically in relation to landscape development.</p> <p><u>Notes for answers</u></p> <p><b>AO1</b></p> <ul style="list-style-type: none"> <li>• Sources of energy in coastal environments: winds, waves (constructive and destructive), currents and tides. Low energy and high energy coasts.</li> <li>• Sediment sources, cells and budgets.</li> <li>• Geomorphological processes: weathering, mass movement, erosion, transportation and deposition.</li> <li>• Distinctively coastal processes: marine: erosion – hydraulic action, wave quarrying, corrasion/abrasion, cavitation, solution, attrition; transportation: traction, suspension (longshore/littoral drift) and deposition; sub-aerial weathering, mass movement and runoff.</li> <li>• Origin and development of landforms and landscapes of coastal erosion: cliffs and wave cut platforms, cliff profile features including caves, arches and stacks; factors and processes in their development.</li> <li>• Case studies of coastal environments at a local scale to illustrate and analyse fundamental coastal processes and their landscape</li> </ul>	<p>20</p> <p><b>AO1=10</b> <b>AO2=10</b></p>
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		<p>outcomes.</p> <p><b>AO2</b></p> <ul style="list-style-type: none"> <li>• Weathering and associated mass movement is particularly important in explaining the development of a number of coastal locations in the UK and abroad. The decisive factor in determining the extent to which mass movement is a dominant process is often the local geology and other physical geographical conditions. There are many different types of mass movement arising out of weathering processes and erosion. These processes vary depending upon location. Many will consider rotational slumping and / or sliding. Here the rock type is a decision factor.</li> <li>• In 1999, Vargas Sate in Venezuela experienced a coastal mud slide. This was as a direct result of prevailing weather conditions and local geology. Heavy rains fell in December 1999 along the north-central coast of Venezuela. Runoff entered channels and rushed towards the sea, picking up sediments along its course. These rains triggered shallow landslides which stripped soil and rock off the landscape and sent them slipping down the steep slopes towards the sea. The additional water liquefied these landslides into debris flows. Over 10,000 people are known to have died in this single event. This evidence suggests that weathering and associated mass movements act entirely independently of coastal processes.</li> <li>• Others may refer to the process of soil creep which again acts independently of any coastal processes and is more likely created by gravity moving soils and sediments downslope with moisture provided as a lubricant.</li> <li>• At Barton on Sea, there is an example of erosion and weathering working together in the process of cliff collapse. The cliffs are composed of gravels, sands and clays. This means that they are easily eroded and have little strength to resist collapse. The gravels and sands, being permeable created a slip plane. They absorbed rainwater, whereas the clay is impermeable. This combined with the undercutting caused a rotational slump and cliff collapse.</li> <li>• Similarly, at Beachy Head in 1999 a huge landslide occurred. This was a product of the combined impact of weathering processes operating sub aerially and coastal erosion caused by strong waves pounding the base of the cliff causing undercutting and vibrations.</li> <li>• For coastlines of erosion expect to see reference to places such as the south coast of the UK and the concordant and discordant geology found the Purbeck region. Here there is a combination of high energy, powerful waves with a large fetch. There is a lack of coastal defence and beaches / shallow water to protect the coastline. As a result, erosion dominates the landscape development in this area. However even here weathering is also shaping the landscape. Old Harry stack is experiencing subaerial weathering and will eventually fall into the sea as a result of this process and the continued undercutting of the stack.</li> <li>• The concept of landscape should emerge in responses.</li> </ul>	
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	<p>Reference to individual landforms rather than the assembly of landforms associated with landscape development is likely to be a feature of a lower end response.</p> <p>Whatever the approach there should be some acknowledgements that along most coastlines, both types of process are acting upon the coastline to shape and develop the landscape features.</p> <p>There should also be some assessment of relative importance.</p>	
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### Marking grid for Question 3

Level/ Mark Range	Criteria/Destructor
<b>Level 4 (16–20 marks)</b>	<ul style="list-style-type: none"> <li>• Detailed evaluative conclusion that is rational and firmly based on knowledge and understanding which is applied to the context of the question. Interpretations are comprehensive, sound and coherent (AO2).</li> <li>• Detailed, coherent and relevant analysis and evaluation in the application of knowledge and understanding throughout (AO2).</li> <li>• Full evidence of links between knowledge and understanding to the application of knowledge and understanding in different contexts (AO2).</li> <li>• Detailed, highly relevant and appropriate knowledge and understanding of place(s) and environments used throughout (AO1).</li> <li>• Full and accurate knowledge and understanding of key concepts, processes and interactions and change throughout (AO1).</li> </ul>
<b>Level 3 (11–15 marks)</b>	<ul style="list-style-type: none"> <li>• Clear evaluative conclusion that is based on knowledge and understanding which is applied to the context of the question. Interpretations are generally clear and support the response in most aspects (AO2).</li> <li>• Generally clear, coherent and relevant analysis and evaluation in the application of knowledge and understanding (AO2).</li> <li>• Generally clear evidence of links between knowledge and understanding to the application of knowledge and understanding in different contexts (AO2).</li> <li>• Generally clear and relevant knowledge and understanding of place(s) and environments (AO1).</li> <li>• Generally clear and accurate knowledge and understanding of key concepts, processes and interactions and change (AO1).</li> </ul>
<b>Level 2 (6–10 marks)</b>	<ul style="list-style-type: none"> <li>• Some sense of an evaluative conclusion partially based upon knowledge and understanding which is applied to the context of the question (AO2). Interpretations are partial but do support the response in places.</li> <li>• Some partially relevant analysis and evaluation in the application of knowledge and understanding (AO2).</li> <li>• Some evidence of links between knowledge and understanding to the application of knowledge and understanding in different contexts (AO2).</li> <li>• Some relevant knowledge and understanding of place(s) and environments which is partially relevant (AO1).</li> <li>• Some knowledge and understanding of key concepts, processes and interactions and change. There may be a few inaccuracies (AO1).</li> </ul>

<b>Level 1 (1–5 marks)</b>	<ul style="list-style-type: none"> <li>• 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). Interpretation is basic.</li> <li>• Very limited analysis and evaluation in the application of knowledge and understanding. This lacks clarity and coherence (AO2).</li> <li>• Very limited and rarely logical evidence of links between knowledge and understanding to the application of knowledge and understanding in different contexts (AO2).</li> <li>• Very limited relevant knowledge and understanding of place(s) and environments (AO1).</li> <li>• Isolated knowledge and understanding of key concepts, processes and interactions and change. There may be a number of inaccuracies. (AO1).</li> </ul>
<b>Level 0 (0 marks)</b>	<ul style="list-style-type: none"> <li>• Nothing worthy of credit.</li> </ul>

**Question 4      Glacial systems and landscapes**

<b>Qu</b>	<b>Part</b>	<b>Marking guidance</b>	<b>Total marks</b>
04	1	<p><b>Outline the process of internal deformation.</b></p> <p>Allow 1 mark per valid point with extra mark(s) for developed points (d).</p> <p><b>AO1 –</b></p> <ul style="list-style-type: none"> <li>• This is a process which explains the movement of cold based glaciers (1).</li> <li>• It explains the slow creep of a glacier at just 1 or 2cm per year (1).</li> <li>• Under great pressure at the base of a glacier, the ice crystals align themselves to the direction of movement of the glacier (1).</li> <li>• The ice develops plasticity and moves (1).</li> <li>• Movement is most likely to place near the bed where the pressures are highest (1).</li> <li>• Cracks can emerge which lead to the formation of crevasses (1).</li> <li>• The glacier remains frozen to the bedrock (1).</li> </ul>	<p>4</p> <p><b>AO1=4</b></p>
04	2	<p><b>Analyse the data shown in Figure 7.</b></p> <p><b>AO3 –</b> Responses should use the resource effectively and appropriately showing understanding of the graph and its complexity of potential inter-relationships. Expect to see analysis of patterns and identification of potential anomalies. There should be use of data in support.</p> <p><u>Mark scheme</u></p> <p><b>Level 2 (4 – 6 marks)</b></p> <p><b>AO3 –</b> Clear analysis and interpretation of the quantitative evidence provided, which makes appropriate use of data in support. Clear</p>	<p>6</p> <p><b>AO3=6</b></p>

		<p>connection(s) between different aspects of the data and evidence.</p> <p><b>Level 1</b> (1 – 3 marks)</p> <p><b>AO3</b> – 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><u>Notes for answers</u></p> <p><b>AO3</b></p> <ul style="list-style-type: none"> <li>• The bore holes show increasing responsiveness to ambient temperature as proximity to the surface decreases.</li> <li>• The bore hole nearest the surface (0.25m depth) shows greatest variability. This ranges from more than 14°C in June 2015 to just below -12°C in April 2010 – a range of 26°C.</li> <li>• Even over this relatively short period of time the overarching trend in temperature, notwithstanding seasonal variation, is upward for this 0.25 metre borehole measurement.</li> <li>• The relationship is inverse between temperature and borehole depth - as depth increases the seasonal temperature ranges decrease.</li> <li>• It is interesting to note that at a depth of 19 metres, the borehole temperature is clearly not affected by seasonal variation in ambient temperature. However even here, over the period of measurement, the temperatures continue to show increases. Even though this is small (at less than 0.5°C) the pattern is sustained suggesting further increases are likely projecting into the future.</li> <li>• It is also clear to see that at the depth of 10 metres, there is an increasing trend away from the 19 metre borehole marker. In other words, back in 2008 the 10 metre borehole recorded very similar data to the 19 metre borehole but by 2015, it has been affected more significantly by ambient temperatures. This is also true of other borehole temperature measurements.</li> </ul>	
04	3	<p><b>Using Figure 8 and your own knowledge, assess the view that fluvioglacial depositional processes dominate in the development of this landscape.</b></p> <p><b>AO1</b> – Knowledge and understanding of fluvial and glacial processes and landforms.</p> <p><b>AO2</b> – Applies knowledge and understanding to the context of the question in assessing role of fluvial and glacial processes in the development of this landscape.</p> <p><u>Mark scheme</u></p>	<p>6</p> <p><b>AO1=2</b> <b>AO2=4</b></p>

	<p><b>Level 2 (4 – 6 marks)</b></p> <p><b>AO1</b> – Demonstrates clear knowledge and understanding of concepts, processes, interactions and change.</p> <p><b>AO2</b> – Applies knowledge and understanding to this novel situation offering clear evaluation and analysis drawn appropriately from the context provided. Connections and relationships between different aspects of study are evident with clear relevance.</p> <p><b>Level 1 (1 – 3 marks)</b></p> <p><b>AO1</b> – Demonstrates basic knowledge and understanding of concepts, processes, interactions and change.</p> <p><b>AO2</b> – Applies limited knowledge and understanding to the novel situation offering only basic evaluation and analysis drawn from the context provided. Connections and relationships between different aspects of study are basic with limited relevance.</p> <p><u>Notes for answers</u></p> <p><b>AO1</b></p> <ul style="list-style-type: none"> <li>• Geomorphological processes – weathering: frost action, nivation; ice movement: internal deformation, rotational, compressional, extensional and basal sliding; erosion: plucking, abrasion; transportation and deposition.</li> <li>• Fluvioglacial processes: meltwater, erosion transportation and deposition.</li> <li>• Ablation and accumulation.</li> <li>• Origin and development of landforms and landscapes of glacial deposition: moraines, till plains.</li> <li>• Fluvioglacial landforms of erosion and deposition: meltwater channels, kames, eskers, outwash plains.</li> </ul> <p><b>AO2</b></p> <ul style="list-style-type: none"> <li>• There is certainly evidence that fluvioglacial processes are at work in this location. The image clearly shows the snout of the glacier and evidence provided in the text suggest that there has been recent accumulation.</li> <li>• Meltwater is emanating from the glacier at a considerable rate from what appears to be an englacial tunnel. The water is dark brown in colour and clearly contains sediments. Where the meltwater crashes to the base of the glacier, it has carved a path through the terminal moraine. A meltwater channel has formed in the foreground. There is also some evidence of sorting of these sediments and it is reasonable to infer this from the image. It may also be inferred that braiding is likely to be occurring and that an outwash plain will have formed beyond the scope of this image.</li> <li>• Some may identify the subglacial tunnel in the centre right of the image. This may lead to esker formation.</li> <li>• There is also evidence of glacial deposition in this image. This is in the form of various types of moraine. The terminal moraine at</li> </ul>	
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		<p>the foreground of the image appears to have been deposited by the melting ice at the snout. Some may use the text based evidence and suggest that this is a push moraine arising as a result various advances and retreats of the glacier.</p> <ul style="list-style-type: none"> <li>• There is also evidence of both supraglacial and englacial moraine. Assuming this is a warm based glacier, this debris will soon join the debris at the snout.</li> </ul> <p>There should be overall recognition that it is not just fluvioglacial deposition shaping this landscape.</p> <p>Generic explanation of the glacial and fluvioglacial landforms (with no attempt to apply knowledge to the image and associated information) should be held to Level 1.</p>	
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04	4	<p><b>'Warming taking place in fragile cold environments is set to generate unprecedented impacts affecting both people and the physical environment.'</b></p> <p><b>To what extent do you agree with this view?</b></p> <p><b>AO1</b> – Knowledge and understanding of process and landforms in glacial environments.</p> <p><b>AO2</b> – Applies knowledge and understanding to the context of the question in assessing the impact of human activity upon the dynamic equilibrium in cold environments.</p> <p><u>Notes for answers</u></p> <p><b>AO1</b></p> <ul style="list-style-type: none"> <li>• Glacial systems including glacial budgets.</li> <li>• Ablation and accumulation – historical patterns of ice advance and retreat.</li> <li>• Fluvioglacial processes: meltwater, erosion transportation and deposition.</li> <li>• Periglacial features and processes: permafrost, active layer and mass movement.</li> <li>• Origin and development of glaciated landscapes.</li> <li>• Characteristic glaciated landscapes.</li> <li>• Characteristic fluvioglacial landscapes.</li> <li>• Characteristic periglacial landscapes.</li> <li>• The relationship between process, time, landforms and landscapes in glaciated settings: characteristic</li> <li>• glaciated and periglacial landscapes.</li> <li>• Concept of environmental fragility. Human impacts on fragile cold environments over time and at a variety of scales. Recent and prospective impact of climate change. Management of cold environments at present and in alternative possible futures.</li> <li>• Case study of a contrasting glaciated landscape from beyond the</li> </ul>	<p>20</p> <p><b>AO1=10</b> <b>AO2=10</b></p>
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		<p>UK to illustrate and analyse how it presents challenges and opportunities for human occupation and development and evaluate human responses of resilience, mitigation and adaptation.</p> <p><b>AO2</b></p> <ul style="list-style-type: none"> <li>• The thrust of the response will largely depend upon the chosen cold environment.</li> <li>• All cold environments are experiencing evidence of warming. Alpine glaciers are generally experiencing ablation with glaciers retreating further and further up into mountainous areas and spring meltwaters occurring seemingly earlier every year. Periglacial areas are experiencing clear evidence of warming, which is affecting the amount and depth of permafrost. Ice sheets are experiencing break up and fragmentation. The North Pole is imminently expected to be ice free during the summer.</li> <li>• Expect most responses to concur with the view that climate change is having a direct impact upon the development of cold environments.</li> <li>• The concept of fragility should emerge in candidate responses. Fragility can be considered in terms of: irreversible damage to natural environments; a chain reaction of knock on effects; the length of recovery from damage. Whichever approach the candidate takes, the concept of fragility should emerge.</li> <li>• In periglacial areas, the earlier and deeper melting of permafrost presents both challenges but also some opportunities. In terms of challenges there should be some reference to increased solifluction and soil erosion on slopes. Some may refer to the increased CO<sup>2</sup> release caused by the increased rates of decomposition in the warmer temperatures. Others may refer to the increased challenges in terms of human occupation and economic exploitation of these areas. There may be some consideration of opportunity generated by the increased availability of what was previously marginal arable and pastoral land in Russia and Canada.</li> <li>• In Alpine glaciated areas, the ablation of glaciers and a reduction in the ice mass balance, presents its own unique set of issues. Earlier and more prolonged ice melting causes a potentially two-fold issue: flooding and potential water shortage in the longer term. There is also the potential impact of a reduction in snow cover for alpine economic activities such as tourism. European ski resorts are increasingly finding that their seasons are shorter and the amount of snow cover thinner in many famous resorts, particularly in the Alps. There are other opportunities though such as warmer climate tourist activities (such mountain rambling), agricultural extension, HEP and mining.</li> <li>• Changes in the extent of the great ice sheets are likely to be considered in the global context. Expect to see reference to sea level change as well as changes to ocean and atmospheric circulation as a result of a reduction of sea ice at the poles. This is</li> </ul>	
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	<p>also likely to be considered in the context of environmental change, species and habitat loss.</p> <p>It is unlikely that many will challenge the assertion in the statement. Some may counterbalance the unprecedented challenges with attempts to manage and mitigate against the potential impacts of climate change in cold environments.</p> <p>There should be some explicit assessment in the context of the question.</p>	
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**Marking grid for Question 4.4**

<b>Level/ Mark Range</b>	<b>Criteria/Descriptor</b>
<b>Level 4 (16–20 marks)</b>	<ul style="list-style-type: none"> <li>• Detailed evaluative conclusion that is rational and firmly based on knowledge and understanding which is applied to the context of the question. Interpretations are comprehensive, sound and coherent (AO2).</li> <li>• Detailed, coherent and relevant analysis and evaluation in the application of knowledge and understanding throughout (AO2).</li> <li>• Full evidence of links between knowledge and understanding to the application of knowledge and understanding in different contexts (AO2).</li> <li>• Detailed, highly relevant and appropriate knowledge and understanding of place(s) and environments used throughout (AO1).</li> <li>• Full and accurate knowledge and understanding of key concepts, processes and interactions and change throughout (AO1).</li> </ul>
<b>Level 3 (11–15 marks)</b>	<ul style="list-style-type: none"> <li>• Clear evaluative conclusion that is based on knowledge and understanding which is applied to the context of the question. Interpretations are generally clear and support the response in most aspects (AO2).</li> <li>• Generally clear, coherent and relevant analysis and evaluation in the application of knowledge and understanding (AO2).</li> <li>• Generally clear evidence of links between knowledge and understanding to the application of knowledge and understanding in different contexts (AO2).</li> <li>• Generally clear and relevant knowledge and understanding of place(s) and environments (AO1).</li> <li>• Generally clear and accurate knowledge and understanding of key concepts, processes and interactions and change (AO1).</li> </ul>
<b>Level 2 (6–10 marks)</b>	<ul style="list-style-type: none"> <li>• Some sense of an evaluative conclusion partially based upon knowledge and understanding which is applied to the context of the question (AO2). Interpretations are partial but do support the response in places.</li> <li>• Some partially relevant analysis and evaluation in the application of knowledge and understanding (AO2).</li> <li>• Some evidence of links between knowledge and understanding to the application of knowledge and understanding in different contexts (AO2).</li> <li>• Some relevant knowledge and understanding of place(s) and environments which is partially relevant (AO1).</li> <li>• Some knowledge and understanding of key concepts, processes and interactions and change. There may be a few inaccuracies (AO1).</li> </ul>

<b>Level 1 (1–5 marks)</b>	<ul style="list-style-type: none"> <li>• 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). Interpretation is basic.</li> <li>• Very limited analysis and evaluation in the application of knowledge and understanding. This lacks clarity and coherence (AO2).</li> <li>• Very limited and rarely logical evidence of links between knowledge and understanding to the application of knowledge and understanding in different contexts (AO2).</li> <li>• Very limited relevant knowledge and understanding of place(s) and environments (AO1).</li> <li>• Isolated knowledge and understanding of key concepts, processes and interactions and change. There may be a number of inaccuracies. (AO1).</li> </ul>
<b>Level 0 (0 marks)</b>	<ul style="list-style-type: none"> <li>• Nothing worthy of credit.</li> </ul>

**Section C****Question 5 Hazards**

<b>Qu</b>	<b>Part</b>	<b>Marking guidance</b>	<b>Total marks</b>
05	1	<b>What are the main characteristic processes operating at destructive plate boundaries?</b> C	1 <b>AO1=1</b>
05	2	<b>Which of the volcanic hazards is being appropriately managed?</b> C	1 <b>AO1=1</b>
05	3	<b>Which is the most significant natural factor leading to the spread of a wildfire?</b> D	1 <b>AO1=1</b>
05	4	<b>What are the characteristics of tsunamis?</b> B	1 <b>AO1=1</b>
05	5	<b>Analyse the data shown in Figure 9 and Figure 10.</b>  <b>AO3</b> – There are two resources to use in conjunction with each other. The skills relate to graphical interpretation and analysis of the map data. Analysis relates to identification of pattern and trends as well as anomaly. Where appropriate there should be some manipulation of data.	6 <b>AO3=6</b>

		<p><u>Mark scheme</u></p> <p><b>Level 2</b> (4 – 6 marks)</p> <p><b>AO3</b> – Clear analysis and interpretation of a geographical issue or question. 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><b>Level 1</b> (1 – 3 marks)</p> <p><b>AO3</b> – Basic analysis and interpretation of a geographical issue or question. 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><u>Notes for answers</u></p> <p><b>AO3</b></p> <ul style="list-style-type: none"> <li>• <b>Figure 9</b> suggests that there might be some correlation between the number of earthquakes and the vertical deformation in the caldera. However, this is by no means strong. For instance, the large peak in 1985 appears to correlate with the peak of vertical deformation of around 30cm. Similarly, around 2006 to 2011, the flurry of earthquakes in that period appears to correlate with another substantial vertical deformation of up to 40+ cm. Some may calculate the growth rate at between 5 and 7 cm per year. However, between 1997 and 2004 there is a sustained period of regular seismic activity but seismic activity shows a decline in vertical deformation.</li> <li>• Some may suggest that over the period in question the caldera is growing despite the relative variation within the data. This includes a period where the data has been estimated. This could be calculated at around 27 cm or 0.3 cm per year approximately.</li> <li>• <b>Figure 10</b> supports some aspects of <b>Figure 9</b> though the timescales for data collection are different. The data suggests an uplift of over 11.2 cm across the central part of the caldera. <b>Figure 10</b> also suggests uplift but not to this degree and it does include the same study area (Sour Creek). <b>Figure 9</b> suggests only around 5cm of uplift during this period.</li> <li>• There is some evidence of clustering of earthquakes and some may argue that these clusters appear more common around major and minor faults. The main cluster appears to the north-west of the caldera, but this is not an area experiencing uplift according to the data. This may be used to challenge the link between vertical deformation and seismic activity.</li> <li>• The vents seem to appear in linear bands stretching from almost north to south across the caldera. There is no obvious link to the vents and either seismic activity or vertical deformation except for one cluster in the centre of the caldera.</li> </ul>	
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05	6	<p><b>How far do you agree that secondary impacts of volcanic eruptions present a greater long-term threat to people than primary impacts?</b></p> <p><b>AO1</b> – Knowledge and understanding of the primary and secondary impacts of volcanoes.</p> <p><b>AO2</b> – Application of knowledge and understanding to assess the extent to which the secondary impacts cause greater long-term damage to populations than the primary impacts.</p> <p><u>Mark scheme</u></p> <p><b>Level 3 (7 – 9 marks)</b></p> <p><b>AO1</b> – Demonstrates detailed knowledge and understanding of concepts, processes, interactions and change. These underpin the response throughout.</p> <p><b>AO2</b> – 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.</p> <p><b>Level 2 (4–6 marks)</b></p> <p><b>AO1</b> – Demonstrates clear knowledge and understanding of concepts, processes, interactions and change. These are mostly relevant though there may be some minor inaccuracy.</p> <p><b>AO2</b> – 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.</p> <p><b>Level 1 (1–3 marks)</b></p> <p><b>AO1</b> – Demonstrates basic knowledge and understanding of concepts, processes, interactions and change. This offers limited relevance with inaccuracy.</p> <p><b>AO2</b> – 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.</p> <p><u>Notes for answers</u></p> <p><b>AO1</b></p> <ul style="list-style-type: none"> <li>• The nature of vulcanicity and its relation to plate tectonics: forms of volcanic hazard: nuées ardentes, lava flows, mudflows, pyroclastic and ash fallout, gases/acid rain, tephra. Spatial distribution, magnitude, frequency, regularity and predictability of hazard events.</li> <li>• Impacts: primary/secondary, environmental, social, economic,</li> </ul>	<p>9</p> <p><b>AO1=4</b> <b>AO2=5</b></p>
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		<p>political.</p> <ul style="list-style-type: none"> <li>Impacts as evidenced by a recent volcanic event.</li> </ul> <p><b>AO2</b></p> <ul style="list-style-type: none"> <li>The focus of the response is impact. Cause and response may feature but protracted narrative is unlikely to remain focused upon the question.</li> <li>There is likely to be a brief distinction made between the two types of hazard. Primary impacts are immediate and arise directly out of the event. Secondary hazards are triggered as a result of the primary hazards and occur in the aftermath.</li> <li>The main primary hazards are pyroclastic flows. These are accepted as the deadliest of the primary impacts responsible for thousands of deaths worldwide. They are impossible to avoid if a person is in the vicinity this is because they travel with great speed and are highly destructive. The other hazards of lava flows, volcanic gases and tephra generally cause less deaths. Lava flows are much easier to avoid. Tephra is highly dangerous but easier to avoid. Volcanic gases are deadly but only in rare circumstances do they cause death. Some may argue that threats to people includes ash fall on farmland as well as destruction of property by lava flows. This is a legitimate approach.</li> <li>Historically it is the secondary impacts which have proven most deadly, even generating global impacts.</li> <li>Lahars are triggered in circumstances where there is rapid ice melt following an eruption. These are perhaps the deadliest of all secondary hazards. Some will point to the impact of the Nevada Del Ruiz eruption in this regard. Floods may also be considered in this context.</li> <li>Whilst tsunamis are more associated with seismic activity under sea water, they can be triggered by volcanic eruptions also.</li> <li>There is also a known and clear link to climate change associated with eruptions. Ash clouds from the Pinatubo were shown to reduce global temperatures by up to 1°C.</li> <li>Some may point to the substantial economic costs associated with the generation of ash clouds, particularly if air travel is disrupted.</li> <li>Some may also consider the global impact of a super eruption. Such an event is likely to present catastrophic primary effect in the region but also in terms of the global climatic impact.</li> </ul> <p>If threat is measured by amount of destruction, greatest loss of life and longest recovery time, then it is likely that most will argue secondary hazards posed the greatest threat.</p>	
05	7	<p><b>With reference to one or more tropical storms that you have studied, assess the extent to which exogenous factors (relationships with other places) assisted with the response to the hazard created.</b></p> <p><b>AO1</b> – Knowledge and understanding of the responses to tropical storms.</p>	<p>9</p> <p><b>AO1=4</b> <b>AO2=5</b></p>

	<p>Knowledge and understanding of potential exogenous factors in response to tropical storms.</p> <p><b>AO2</b> – Application of knowledge and understanding in evaluating the potential support offered from outside the area where the hazard struck, particularly in helping to minimise the impact of the hazard.</p> <p><u>Mark scheme</u></p> <p><b>Level 3</b> (7–9 marks)</p> <p><b>AO1</b> – Demonstrates detailed knowledge and understanding of concepts, processes, interactions and change. These underpin the response throughout.</p> <p><b>AO2</b> – 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.</p> <p><b>Level 2</b> (4–6 marks)</p> <p><b>AO1</b> – Demonstrates clear knowledge and understanding of concepts, processes, interactions and change. These are mostly relevant though there may be some minor inaccuracy.</p> <p><b>AO2</b> – 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.</p> <p><b>Level 1</b> (1–3 marks)</p> <p><b>AO1</b> – Demonstrates basic knowledge and understanding of concepts, processes, interactions and change. This offers limited relevance with inaccuracy.</p> <p><b>AO2</b> – 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.</p> <p><u>Notes for answers</u></p> <p><b>AO1</b></p> <ul style="list-style-type: none"> <li>• The characteristics and impacts of external forces operating at different scales from local to global, including either government policies or the decisions of multinational corporations or the impacts of international or global institutions.</li> <li>• Factors contributing to the character of places: Exogenous: relationships with other places.</li> <li>• The nature of tropical storms and their underlying causes. Forms of storm hazard: high winds, storm surges, coastal flooding, river flooding and landslides. Spatial distribution, magnitude,</li> </ul>	
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		<p>frequency, regularity, predictability of hazard events.</p> <ul style="list-style-type: none"> <li>• Impacts: primary/secondary, environmental, social, economic, political.</li> <li>• Short and long-term responses: risk management designed to reduce the impacts of the hazard through preparedness, mitigation, prevention and adaptation.</li> <li>• Impacts and human responses as evidenced by two recent tropical storms in contrasting areas of the world.</li> </ul> <p><b>AO2</b></p> <ul style="list-style-type: none"> <li>• Candidates are required to study two contrasting storm events. Expect to see some responses which make contrasts between the two events in the extent to which exogenous factors contributed to the management of these events. However, this is not a requirement or an expectation of the question.</li> <li>• Exogenous factors are concerned with the relationships to other places either within the same country or beyond.</li> <li>• The thrust of the question is concerned with the extent to which these exogenous factors contributed to the management process and recovery after the event.</li> <li>• Hurricane Sandy struck the east coast of the USA in 2012. This was a major hurricane causing an estimated \$32 billion in repair costs and directly causing the death of 53 people.</li> <li>• Exogenous factors here related to the way in which outside help was sought. For example, Barack Obama signed an emergency declaration shortly after the end. This guaranteed federal assistance in the recovery effort.</li> <li>• As a result of a declaration of public health emergency, The Federal Emergency Management Agency (FEMA), sent over 30 teams of workers into New York, to help with the recovery.</li> <li>• It is important to note that the state of New York set up an emergency fund of \$100 million in order to support affected people. Some may point out that it was not just exogenous factors which helped with the recovery in this instance.</li> <li>• By unfortunate coincidence the New York marathon was scheduled at the same time that the hurricane struck. Thousands of runners from outside of the area came to support the relief effort.</li> <li>• This and many other actions meant that the death toll was relatively low for a such as strong hurricane and it appeared as though the federal government had learned the lessons from Hurricane Katrina which had a disastrous impact just a few years earlier.</li> <li>• In this sense exogenous factors through federal government support, were pivotal in the relief effort. Without this the recovery operation would certainly have taken longer with greater long-term damage.</li> </ul>	
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05	8	<p><b>With reference to a multi-hazardous environment that you have studied, assess the view that the underlying cause(s) leading to the hazards is human activity rather than physical factors.</b></p> <p><b>AO1</b> – Knowledge and understanding of a named multi hazardous environment. Aware of the factors which have contributed to generate the hazards.</p> <p><b>AO2</b> – Application of knowledge and understanding to identify and assess the causes of hazards in multi hazardous environments.</p> <p><u>Notes for answers</u></p> <p>The direction of the response largely depends upon the chosen case study of the multi hazardous environment as well as the hazards contained within that location.</p> <p><b>AO1</b></p> <ul style="list-style-type: none"> <li>• Case study of a multi-hazardous environment beyond the UK to illustrate and analyse the nature of the hazards and the social, economic and environmental risks presented, and how human qualities and responses such as resilience, adaptation, mitigation and management contribute to its continuing human occupation.</li> <li>• Nature, forms and potential impacts of natural hazards (geophysical, atmospheric and hydrological). Hazard perception and its economic and cultural determinants. Characteristic human responses – fatalism, prediction, adjustment/adaptation, mitigation, management, risk sharing – and their relationship to hazard incidence, intensity, magnitude, distribution and level of development. The Park model of human response to hazards. The Hazard Management Cycle.</li> </ul> <p><b>AO2</b></p> <ul style="list-style-type: none"> <li>• Los Angeles, USA is considered to be a multi hazard environment though other case studies may feature. Expect to reference to places such as Haiti, The Philippines and Japan.</li> <li>• In Los Angeles, it would be difficult to argue to that all hazards are generated by human activity. As an advanced economy, the city has the economic advantage of being able to manage many of its hazards, though not all are easily manageable or predictable. Lying close to the San Andreas Fault (with a number of other minor faults in the area such as the Northridge / Santa Barbara Fault), the area is prone to significant seismic activity. It is not possible to argue that this root cause is human activity in this regard. However, managing the impact of the hazard is a significant preoccupation and human endeavour in the area. Some may argue that hazard is made more or less dangerous by the extent of management of the hazard. This is a legitimate approach. There are other hazards though which are certainly the product of human activity.</li> <li>• Wildfire periodically affects the Los Angeles basin. Whilst the main cause is the flammability of vegetation as a result of drought</li> </ul>	<p>20</p> <p><b>AO1=10</b> <b>AO2=10</b></p>
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		<p>and the dry vegetation, human factors certainly exacerbate the issue. Human activity is known to start wildfire and building in areas prone to wildfire inevitably adds to the problem. Expect to see reference to recent events in support eg June '17 four major brush fires struck LA, affecting over 6000 acres of land. It was sparked by a car crash in the San Jacinto mountains. However, it was also fuelled by high temperatures, low humidity and wind gusts of up to 35 mph. This shows that in this case, it was a combination of human and physical factors which created this hazard.</p> <p>Whatever the approach, there should be more than one hazard considered and a clear overarching response to the question.</p>	
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## Marking grid for Question 5.8

Level/ Mark Range	Criteria/Descriptor
<b>Level 4 (16–20 marks)</b>	<ul style="list-style-type: none"> <li>• Detailed evaluative conclusion that is rational and firmly based on knowledge and understanding which is applied to the context of the question. Interpretations are comprehensive, sound and coherent (AO2).</li> <li>• Detailed, coherent and relevant analysis and evaluation in the application of knowledge and understanding throughout (AO2).</li> <li>• Full evidence of links between knowledge and understanding to the application of knowledge and understanding in different contexts (AO2).</li> <li>• Detailed, highly relevant and appropriate knowledge and understanding of place(s) and environments used throughout (AO1).</li> <li>• Full and accurate knowledge and understanding of key concepts, processes and interactions and change throughout (AO1).</li> </ul>
<b>Level 3 (11–15 marks)</b>	<ul style="list-style-type: none"> <li>• Clear evaluative conclusion that is based on knowledge and understanding which is applied to the context of the question. Interpretations are generally clear and support the response in most aspects (AO2).</li> <li>• Generally clear, coherent and relevant analysis and evaluation in the application of knowledge and understanding (AO2).</li> <li>• Generally clear evidence of links between knowledge and understanding to the application of knowledge and understanding in different contexts (AO2).</li> <li>• Generally clear and relevant knowledge and understanding of place(s) and environments (AO1).</li> <li>• Generally clear and accurate knowledge and understanding of key concepts, processes and interactions and change (AO1).</li> </ul>
<b>Level 2 (6–10 marks)</b>	<ul style="list-style-type: none"> <li>• Some sense of an evaluative conclusion partially based upon knowledge and understanding which is applied to the context of the question (AO2). Interpretations are partial but do support the response in places.</li> <li>• Some partially relevant analysis and evaluation in the application of knowledge and understanding (AO2).</li> <li>• Some evidence of links between knowledge and understanding to the application of knowledge and understanding in different contexts (AO2).</li> <li>• Some relevant knowledge and understanding of place(s) and environments which is partially relevant (AO1).</li> <li>• Some knowledge and understanding of key concepts, processes and interactions and change. There may be a few inaccuracies (AO1).</li> </ul>
<b>Level 1 (1–5 marks)</b>	<ul style="list-style-type: none"> <li>• 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). Interpretation is basic.</li> <li>• Very limited analysis and evaluation in the application of knowledge and understanding. This lacks clarity and coherence (AO2).</li> <li>• Very limited and rarely logical evidence of links between knowledge and understanding to the application of knowledge and understanding in different contexts (AO2).</li> <li>• Very limited relevant knowledge and understanding of place(s) and environments (AO1).</li> <li>• Isolated knowledge and understanding of key concepts, processes and interactions and change. There may be a number of inaccuracies (AO1).</li> </ul>

<b>Level 0 (0 marks)</b>	<ul style="list-style-type: none"> <li>Nothing worthy of credit.</li> </ul>
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**Question 6 Ecosystems under stress**

Qu	Part	Marking guidance	Total marks
06	1	<p><b>Which of the following are adaptations found in savanna vegetation?</b></p> <p>C</p>	<p>1</p> <p><b>AO1=1</b></p>
06	2	<p><b>What is a pioneer species?</b></p> <p>C</p>	<p>1</p> <p><b>AO1=1</b></p>
06	3	<p><b>What is net primary productivity (NPP)?</b></p> <p>A</p>	<p>1</p> <p><b>AO1=1</b></p>
06	4	<p><b>Where are coral reefs typically found?</b></p> <p>A</p>	<p>1</p> <p><b>AO1=1</b></p>
06	5	<p><b>Analyse the data shown in Figure 11 and Figure 12.</b></p> <p><b>AO3</b> – There are three resources to use in conjunction with each other. The skills relate to graphical interpretation and analysis of the map data. Analysis relates to identification of pattern and trends as well as anomaly. Where appropriate there should be some manipulation of data.</p> <p><u>Mark scheme</u></p> <p><b>Level 2</b> (4 – 6 marks)</p> <p><b>AO3</b> – 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><b>Level 1</b> (1– 3 marks)</p> <p><b>AO3</b> – 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>6</p> <p><b>AO3=6</b></p>

		<p><u>Notes for answers</u></p> <p><b>AO3</b></p> <ul style="list-style-type: none"> <li>• <b>Figure 11</b> shows the main trophic index which indicates the status of the top sea predators in different areas around European and North African coastal waters. Every area, except the Mediterranean is experiencing some level of decline in its top predators. The Baltic Sea has lost around 11% of its top predators. The median is around 4.5 – 5%.</li> <li>• <b>Figure 12</b> further supports the notion of over fishing and the exhaustion of fish stocks. All areas are experiencing some degree of depletion in their fish stocks. The North Sea for example has a relatively large catch; Over ¼ of its 23 species sampled are classed as overfished, with fishing beyond safe limits in these fish species. It is perhaps a little surprising to note that this area has only seen a 5% drop in its top marine predators between 1950 and 2004 according to the data. This would suggest that top marine predators are not intentionally caught.</li> <li>• <b>Figure 12</b> shows some real concern in the Mediterranean. Whilst the species sampled are relatively small (eg 4 in the Gulf of Lions), there is a generally a significant issue of overfishing of stocks. The Aegean for example has approximately 7 of the 11 species sampled as being overfished. However there is no change in top marine predators in the Mediteranean. Insummary this area has lots of overfishing of stocks but no change in top marine predators. Some may theorise that top marine perdaters were removed before 1950 and that there are relatively few left. This is a legitimate analysis.</li> </ul>	
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06	6	<p><b>Analyse the human and ecological inter-relationships which lead to the development of a plagioclimax.</b></p> <p><b>AO1</b> – Knowledge and understanding of the concept of plagioclimax. Awareness of the human and ecological factors in which plagioclimax occurs.</p> <p><b>AO2</b> – Application of knowledge and understanding to analyse the human and ecological inter-relationships which allow plagioclimax communities to develop.</p> <p><u>Mark scheme</u></p> <p><b>Level 3</b> (7 – 9 marks)</p> <p><b>AO1</b> – Demonstrates detailed knowledge and understanding of concepts, processes, interactions and change. These underpin the response throughout.</p> <p><b>AO2</b> – 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</p>	<p>9</p> <p><b>AO1=4</b> <b>AO2=5</b></p>
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	<p>supported with appropriate evidence.</p> <p><b>Level 2</b> (4 – 6 marks)</p> <p><b>AO1</b> – Demonstrates clear knowledge and understanding of concepts, processes, interactions and change. These are mostly relevant though there may be some minor inaccuracy.</p> <p><b>AO2</b> – Applies clear knowledge and understanding appropriately. Connections and relationships between different aspects of study are evident with some relevance. Analysis is evident and supported with clear and appropriate evidence.</p> <p><b>Level 1</b> (1 – 3 marks)</p> <p><b>AO1</b> – Demonstrates basic knowledge and understanding of concepts, processes, interactions and change. This offers limited relevance with inaccuracy.</p> <p><b>AO2</b> – 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><u>Notes for answers</u></p> <p><b>AO1</b></p> <ul style="list-style-type: none"> <li>• Concepts of succession: seral stages, climatic climax, sub-climax and plagioclimax.</li> <li>• Nature of terrestrial ecosystems and the inter-connections between climate, vegetation, soil and topography which produce them. Ecosystem responses to changes in one or more of their components or environmental controls.</li> <li>• Factors influencing the changing of ecosystems, including climate change and human exploitation of the environment.</li> <li>• The effects of human activity on succession – illustrated by one plagioclimax such as a heather moorland.</li> </ul> <p><b>AO2</b></p> <ul style="list-style-type: none"> <li>• Heather moorland is likely to feature in many responses but any plagioclimax community is permissible. The key is that some modification has taken place by human activity which leads to the development of the plagioclimax. Also, there should be some acknowledgement of the ongoing nature of human activity which continues to restrict the community in reaching climatic climax.</li> <li>• There should also be some reference to the unique ecology which is either promoted by human activity and / or which takes advantages of the niche created by human activity through its adaptations to the local environmental conditions, namely the climate and soils.</li> <li>• Heather moorland is a highly adapted plagioclimax vegetation community which is almost exclusive to the British Isles. It is</li> </ul>	
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		<p>present due to complex inter-related ecological factors and human activities over the last 5000 years in upland Britain.</p> <ul style="list-style-type: none"> <li>• Moorlands and upland heathlands exist above 250m, on mainly impervious rocks eg Millstone Grits of the Pennines. These provide acidic soils which are low nutrient. The relatively high altitude typically has stronger, more frequent winds, lower temperatures and increased precipitation (around 1250mm per year). Cloud cover also limits levels of insolation.</li> <li>• The climax vegetation is woodland, but evidence suggests that this was cleared many thousands of years ago to make way for pasture land by early settlers to UK upland. This created the circumstances for the plagioclimax to develop.</li> <li>• The heather is comprised of small evergreen leaves which contain resin, adapted in this way to reduce water loss from transpiration. They are also adapted to grow in low-nutrient soils by having fungi in their roots which help breakdown organic matter and minerals for absorption.</li> <li>• The main human activities designed to maintain the equilibrium are: burning vegetation; using wood as ground coverage to reduce competition from other species; using the land for grazing domestic livestock also restricts the growth of other species.</li> <li>• Without the continued interference of human activity the heather would eventually be outcompeted by trees capable of thriving in that climate and soil condition.</li> </ul>	
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06	7	<p><b>Assess the importance of global governance in securing the long-term health and survival of coral reefs.</b></p> <p><b>AO1</b> – Knowledge and understanding of global governance in coordinating responses to environmental concerns. Knowledge and understanding of the factors affecting the health and survival of coral.</p> <p><b>AO2</b> – Application of knowledge and understanding to analyse the potential role of global governance in securing the long-term future, health and survival of coral reefs.</p> <p><u>Mark scheme</u></p> <p><b>Level 3</b> (7 – 9 marks)</p> <p><b>AO1</b> – Demonstrates detailed knowledge and understanding of concepts, processes, interactions and change. These underpin the response throughout.</p> <p><b>AO2</b> – 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.</p>	<p>9</p> <p><b>AO1=4</b> <b>AO2=5</b></p>
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	<p><b>Level 2</b> (4 – 6 marks)</p> <p><b>AO1</b> – Demonstrates clear knowledge and understanding of concepts, processes, interactions and change. These are mostly relevant though there may be some minor inaccuracy.</p> <p><b>AO2</b> – 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.</p> <p><b>Level 1</b> (1 – 3 marks)</p> <p><b>AO1</b> – Demonstrates basic knowledge and understanding of concepts, processes, interactions and change. This offers limited relevance with inaccuracy.</p> <p><b>AO2</b> – 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.</p> <p><u>Notes for answers</u></p> <p><b>AO1</b></p> <ul style="list-style-type: none"> <li>• The emergence and developing role of norms, laws and institutions in regulating and reproducing global systems.</li> <li>• Issues associated with attempts at global governance, including how interactions between the local, regional, national, international and global scales are fundamental to understanding global governance.</li> <li>• Analysis and assessment of the geographical consequences of global governance for citizens and places in Antarctica and elsewhere to specifically consider how global governance underlies and impacts on students' and other people's lives across the globe.</li> <li>• The distribution and main characteristics of coral reef ecosystems. Environmental conditions associated with reef development.</li> <li>• Factors in the health and survival of reefs: Natural: Water temperature, acidity, salinity, algal blooms.</li> <li>• Human activity and its impact: Major drainage basin schemes, onshore development, desalination, pollution, tourism, fishing.</li> <li>• Future prospects for coral reefs.</li> </ul> <p><b>AO2</b></p> <ul style="list-style-type: none"> <li>• The long-term health and survival of coral arguably lies beyond the means of individual countries to address. This question invites a broad consideration of the potential opportunities which exist to forge a, local, national, regional and international approach to the protection of coral.</li> <li>• As coral is found in so many parts of the world's seas and oceans, a unilateral approach to coral's long-term management is unlikely to bear fruit. Whilst local measures can be taken in order</li> </ul>	
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		<p>to control the worst impacts of fishing and the impacts of tourism, wider agreement and co-operation around pollution levels and sea temperature are needed to fully address the sustainability question.</p> <ul style="list-style-type: none"> <li>• The main threat facing coral are: bleaching caused by the expulsion of algae following stress from temperature change or change in nutrient levels; pollution of local water systems by industry and services such as tourism; highly damaging activities such as dynamite fishing.</li> <li>• Actions to address this clearly lie within the remits of government organisations. National governments have been taking their own measures to protect coral from destruction. In Australia, the government is investing over \$200 annually in the protection and restoration of the Great Barrier Reef. It has a Reef 2050 plan which is concerned with the long-term sustainability of the reef. It has also established and funded a reef trust at a cost of \$40 million. Its role is to re-establish the ecosystems along the reef.</li> <li>• However, these actions alone cannot address the wider issues associated with sea temperature changes and ocean water quality. These are principle threat facing coral.</li> <li>• The United Nations is one such organisation which has the potential to support the conservation of coral. Students are unlikely to go much further than to suggest broad ways in which organisations such as the UN could act to protect coral. Others may apply their learning from the Global Commons in the context of coral conservation. Both approaches are legitimate.</li> <li>• Some may offer more detailed knowledge. For example, in 2016 the UN agreed a resolution on sustainable coral reef management. It focused upon coral reef and climate change resilience; coral reef policy instruments; development and implementation of national or regional measures and action plans; and development of indicators and assessment of coral reef status and trends.</li> </ul> <p>Whatever the approach there should be some recognition that addressing the coral ecosystem requires a concerted global effort and not solely action by individual countries.</p>	
06	8	<p><b>'It is simply not possible to find a true balance between biodiversity and sustainable economic development in savanna grasslands. Economic development will always come at the expense of biodiversity.'</b></p> <p><b>To what extent do you agree with this view?</b></p> <p><b>AO1</b> – Knowledge and understanding of factors affecting savanna grassland - The natural ecosystem and the human pressures affecting the environment. Knowledge and understanding of the concept of biodiversity.</p>	<p>20</p> <p><b>AO1=10</b> <b>AO2=10</b></p>

	<p><b>AO2</b> – Application of knowledge and understanding to evaluate the extent to which the savanna is a fragile environment.</p> <p><u>Notes for answers</u></p> <p><b>AO1</b></p> <ul style="list-style-type: none"> <li>• The concept of biodiversity. Local and global trends in biodiversity. Causes, rates and potential impacts of declining biodiversity.</li> <li>• Ecosystems and their importance for human populations in the light of continuing population growth and economic development. Human populations in ecosystem development and sustainability.</li> <li>• Factors influencing the changing of ecosystems, including climate change and human exploitation of the global environment.</li> <li>• The concept of the biome. The global distribution of major terrestrial biomes.</li> <li>• The nature of savanna grassland to include: <ul style="list-style-type: none"> <li>• its main characteristics</li> <li>• ecological responses to the climate, soil and soil moisture budget – adaptations by flora and fauna</li> <li>• human activity and its impact</li> </ul> </li> <li>• Typical development issues in each biome to include changes in population, economic development, agricultural extension and intensification, implications for biodiversity and sustainability.</li> </ul> <p><b>AO2</b></p> <ul style="list-style-type: none"> <li>• Responses are expected to consider a range of economic activities taking place in the savanna as well as the impacts of this activity, specifically upon the biodiversity.</li> <li>• Some may also consider attempts to manage the grassland more sustainably so that species of plant and animal are protected into the future.</li> <li>• The focus of the response is economic activity and its impact upon biodiversity. Narrative into the broader environmental fragility is not being assessed in this question.</li> <li>• Similarly, management should be focused specifically upon restoring the ecological balance rather than general environmental gains.</li> <li>• Expect to see reference to a range of economic activities. It is worth noting subsistence farming, for instance practiced by aboriginal people serves no economic gain. When savanna is cleared for the purposes of commercial planting, this clearly constitutes a loss of diversity. Intentional starting of fire may also feature as a threat; its purpose to clear the land for agriculture. Only pyrophytic species are likely to survive.</li> <li>• Trophy hunting tourism targeting big game in the African savanna certainly constitutes a threat. Similarly poaching for elephant tusks or rhino horn has caused considerable threat, more recently since the ivory ban has been lifted in 2007.</li> <li>• Some may refer to incursions in the grassland caused by development of settlements. This is valid and constitutes</li> </ul>	
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		<p>economic activity.</p> <ul style="list-style-type: none"> <li>• Specific species under threat include the Cheetah which has lost grazing land and is facing increased competition from other predators such as Hyenas. The Black Rhino is now only found in 4 countries as a result of poaching.</li> <li>• Expect to reference to a range of plant species threatened by extensive land clear and / loss of wetland habitats these include: Acacia, Baobab, Bermuda Grass, Candelabra Tree, Elephant Grass. Clearance of this natural vegetation also impacts further down the food chain affecting the primary consumers. This can cause problems to the whole of the food web.</li> <li>• Some may also consider the unintended introduction of pests such as locust swarms attracted by the food source provided by commercial farming. These swarms can also wipe out the indigenous vegetation again affected the rest of the food web.</li> <li>• Some may consider measures designed to restore and conserve grasslands. Expect to see local case studies of good practice. These measures are likely to revolve around: education on measures to prevent soil erosion; restoration of wetlands, which are an important part of grassland ecology; agricultural training especially around crop rotation to prevent the sapping of nutrients. Indigenous tree planting to act as windbreaks and provide shade; Controlled dry season burning to obtain fresh growth and to restore calcium to the soil that builds up in the dry grasses.</li> <li>• Some may also consider ecotourism as one potential small scale solution to conservation. There is also a debate around hunting. Controlled hunting may actually offer one viable solution for habitat protection. However, it comes at a price which some would say is too high.</li> </ul> <p>Candidates are free to form their own conclusions based upon preceding content. However, it is likely that most will agree with the statement as posed.</p>	
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## Marking grid for Question 6.8

Level/ Mark Range	Criteria/Descriptor
<b>Level 4 (16–20 marks)</b>	<ul style="list-style-type: none"> <li>• Detailed evaluative conclusion that is rational and firmly based on knowledge and understanding which is applied to the context of the question. Interpretations are comprehensive, sound and coherent (AO2).</li> <li>• Detailed, coherent and relevant analysis and evaluation in the application of knowledge and understanding throughout (AO2).</li> <li>• Full evidence of links between knowledge and understanding to the application of knowledge and understanding in different contexts (AO2).</li> <li>• Detailed, highly relevant and appropriate knowledge and understanding of place(s) and environments used throughout (AO1).</li> <li>• Full and accurate knowledge and understanding of key concepts, processes and interactions and change throughout (AO1).</li> </ul>
<b>Level 3 (11–15 marks)</b>	<ul style="list-style-type: none"> <li>• Clear evaluative conclusion that is based on knowledge and understanding which is applied to the context of the question. Interpretations are generally clear and support the response in most aspects (AO2).</li> <li>• Generally clear, coherent and relevant analysis and evaluation in the application of knowledge and understanding (AO2).</li> <li>• Generally clear evidence of links between knowledge and understanding to the application of knowledge and understanding in different contexts (AO2).</li> <li>• Generally clear and relevant knowledge and understanding of place(s) and environments (AO1).</li> <li>• Generally clear and accurate knowledge and understanding of key concepts, processes and interactions and change (AO1).</li> </ul>
<b>Level 2 (6–10 marks)</b>	<ul style="list-style-type: none"> <li>• Some sense of an evaluative conclusion partially based upon knowledge and understanding which is applied to the context of the question (AO2). Interpretations are partial but do support the response in places.</li> <li>• Some partially relevant analysis and evaluation in the application of knowledge and understanding (AO2).</li> <li>• Some evidence of links between knowledge and understanding to the application of knowledge and understanding in different contexts (AO2).</li> <li>• Some relevant knowledge and understanding of place(s) and environments which is partially relevant (AO1).</li> <li>• Some knowledge and understanding of key concepts, processes and interactions and change. There may be a few inaccuracies (AO1).</li> </ul>
<b>Level 1 (1–5 marks)</b>	<ul style="list-style-type: none"> <li>• 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). Interpretation is basic.</li> <li>• Very limited analysis and evaluation in the application of knowledge and understanding. This lacks clarity and coherence (AO2).</li> <li>• Very limited and rarely logical evidence of links between knowledge and understanding to the application of knowledge and understanding in different contexts (AO2).</li> <li>• Very limited relevant knowledge and understanding of place(s) and environments (AO1).</li> <li>• Isolated knowledge and understanding of key concepts, processes and interactions and change. There may be a number of inaccuracies (AO1).</li> </ul>

<b>Level 0 (0 marks)</b>	<ul style="list-style-type: none"><li>• Nothing worthy of credit.</li></ul>
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