A-level GEOGRAPHY
PAPER 1
PHYSICAL GEOGRAPHY

Mark scheme
Additional specimen

V1.1
Mark schemes are prepared by the Lead Assessment Writer and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation events which all associates participate in and is the scheme which was used by them in this examination. The standardisation process ensures that the mark scheme covers the students’ responses to questions and that every associate understands and applies it in the same correct way. As preparation for standardisation each associate analyses a number of students’ scripts. Alternative answers not already covered by the mark scheme are discussed and legislated for. If, after the standardisation process, associates encounter unusual answers which have not been raised they are required to refer these to the Lead Assessment Writer.

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

Further copies of this mark scheme are available from aqa.org.uk
Level of response marking instructions

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

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

Step 1 Determine a level

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

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

Step 2 Determine a mark

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

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

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

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

### AO1
- This process involves natural and/or artificial methods by which carbon is captured and stored in solid or liquid form (1). Max 1 for definition.
- The purpose is to remove carbon from the atmosphere, thus reducing human induced contribution to CO₂ levels and the possible link to global warming (1 + 1 with development). Max 2 for purpose.
- One artificial method involves the capture of CO₂ from coal fired power plants. The captured carbon is then piped underground and stored in rock strata porous enough to hold CO₂. (1 + 1 with development). Max 2 for artificial methods.
- One natural method involves working with natural processes to create natural carbon sinks. The development of peat bogs will stop vegetation decay. By creating new bogs or enhancing existing bogs, carbon sequestration will naturally occur (1 + 1 with development). Max 2 for natural methods.

### AO3
- AO3 – There should be detailed analysis of the overarching pattern in the climatic water balance but also the extent to which there is variation over the period involved, using the three years’ data.

#### Level 2 (4–6 marks)
- AO3 – Clear analysis of the quantitative evidence provided, which makes appropriate use of data in support. Clear connection(s) between different aspects of the data and evidence.

#### Level 1 (1–3 marks)
- AO3 – Basic analysis of the quantitative evidence provided, which makes limited use of data and evidence in support. Basic connection(s) between different aspects of the data and evidence.

**Notes for answers AO3**
- The typical pattern (using the 1961–1990) average shows that from January to July (approximately), the area has a surplus balance. That maximum surplus is around 80–90 mm in May. In July this falls to 0 mm. The peak deficit is reached mid-October and this is around 90–95 mm before returning to 0 mm late December.
• Some may suggest that the 30-year average shows an overall annual balance of 0, ie despite the seasonal peaks and troughs, there is an overall balance between precipitation and evapotranspiration and the area is becoming neither wetter or drier.

• When considering annual variation against the 30-year average there is considerable difference between the three years but also variance against the 30-year average.

• Two of the years are significantly drier than the 30-year average. These are 2003 and 2008. In 2003, the deficit started 2 months earlier in May and the year ended close to 300 mm in deficit. Analysis may suggest that this was either an extremely dry or hot year.

• In 2008, there was a peak balance of around 130 mm in May. This was well above the mean line of approximately 80 mm. However, the deficit still occurred earlier (mid-June) than the mean line. This year ended with an overall deficit of around 95 mm which would almost certainly have been lower had it not been for the peak in May.

• The significant anomaly year was 2007. Despite a trough in May, the area experienced a year of surplus climatic water balance with cumulative precipitation exceeding potential evapotranspiration for the entire year. The year ended on a surplus of approximately 140 mm.

• Some may go a little further and make the point that this balance is a cyclical phenomenon and a new 30-year average might better indicate any localised climate change phenomena.

AO1 = 2  
AO2 = 4  
6
the context provided. Connections and relationships between different aspects of study are basic with limited relevance.

**Notes for answers**

**AO1**
- Changes in the carbon cycle over time, to include natural variation (including wild fires, volcanic activity) and human impact (including hydrocarbon fuel extraction and burning, farming practices, deforestation, land use changes).
- The carbon budget and the impact of the carbon cycle upon land, ocean and atmosphere, including global climate.
- Human interventions in the carbon cycle designed to influence carbon transfers and mitigate the impacts of climate change.

**AO2**
- There are a variety of ways of approaching this question.
- Some may consider the challenges in terms of the evidence provided. There is very little evidence to support the view that the world’s climate is headed for emissions increases which will lead to 3-4°C of warming. Some may point towards the trajectory in the data in support of this position.
- Even by 2015 emissions of around 50gt CO₂ were being emitted, placing the climatic impact on a trajectory well above the 2°C expected impact.
- Arguably the bigger issue is that even staying within a 2°C climate range has serious climatic impacts. Expect to see reference to the challenges associated with melting ice sheets, coral ecosystem damage, food security issues, extreme heat waves etc.
- Another approach might be to consider the challenges on the production side of the debate. To stay below a 2°C global temperature increase, there would need to be a considerable reduction of emissions now. Given the rapid rate of population growth and the associated rising demand for fossil fuels, it is hard to see how these conflicting demands can be met. When this is added to land clearance for farming and mineral extraction, the challenge is only exacerbated further.
<table>
<thead>
<tr>
<th>AO1</th>
<th>Knowledge and understanding of the inter-relationships which exist between the water cycle and the carbon cycle.</th>
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<tbody>
<tr>
<td>AO2</td>
<td>Application of knowledge and understanding to assess the extent to which there is a fragile relationship between the two cycles and whether human activity has caused irreversible damage to this relationship.</td>
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</tbody>
</table>

**Notes for answers**

**AO1**
- Systems in physical geography: systems concepts and their application to the water and carbon cycles inputs – outputs, energy, stores/components, flows/transfers, positive/negative feedback, dynamic equilibrium.
- 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.
- Changes in the carbon cycle over time, to include natural variation (including wild fires, volcanic activity) and human impact (including hydrocarbon fuel extraction and burning, farming practices, deforestation, land use changes).
- The 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.
- The role of feedbacks within and between cycles and their link to climate change and implications for life on Earth.
- Human interventions in the carbon cycle designed to influence carbon transfers and mitigate the impacts of climate change.
- Possible 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.

**AO2**
- Expect to see a variety of scales in response to this question.
- Some will consider inter-relationships at the level of the small-scale ecosystem whilst others will consider regional scale inter-relationships in biomes. Another alternative relates to the global inter-relationships including atmospheric CO₂ and precipitation.
- At the scale of a local ecosystem, expect to see concepts of fragility explored in relation to the impact of human activity upon inter-relationships within the ecosystem. For example, both the carbon cycle and water cycle can be disrupted by a range of human activity including farming, vegetation clearing, establishment of plagio-climax vegetation communities and work on local rivers and the associated catchments.
- At the local scale, some may consider positive actions to support the balance between the two cycles. Afforestation and peat bog development could be referenced as long as it
is clear how these activities impact upon the inter-relationships between the cycles.

- At the regional scale, some may consider the impact of atmospheric changes at the regional scale. For instance, in tropical forests, wide scale removal of vegetation is known to disrupt the cycling of water through convection rainfall. The lack of transpiration causes a reduction in precipitation rates. This in turn can cause a devastating impact upon rainforest vegetation, especially tree growth. Where this occurs, the carbon cycle is effectively broken.
- Wide scale removal of vegetation can also impact upon the soil carbon stores. The carbon stores are removed through rain splash impact and surface runoff. Rivers carry away soil which contained an important store of carbon.
- Some may consider drylands as another place where there is a potentially damaging impact of human activity upon the carbon and water cycles. This is particularly the case where precipitation is reduced or where irrigation channels water away from certain locations.
- Some may make the link between large scale vegetation removal and an increase in weathering. This can trigger slow carbon release through the weathering processes of rocks containing carbon.
- At the global scale, increased carbon emissions are likely to feature. These must clearly be linked to the inter-relationship between water and carbon in order to access credit for AO2.
- Mitigation strategies to reduce CO₂ may feature but these must be clearly linked to the inter-relationships between water and carbon for AO2 credit.
- Expect to see some overarching evaluation as to the extent to which the inter-relationships are fragile but also how the extent to which any damage is irreversible.
### Marking grid for Question 1.4

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

| Level 0  | Nothing worthy of credit. | (0 marks) |
Section B

<table>
<thead>
<tr>
<th>02</th>
<th>1</th>
<th>Allow 1 mark for each valid point with additional marks for developed points (d).</th>
<th>AO1 = 4</th>
<th>4</th>
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<tbody>
<tr>
<td></td>
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<td><strong>AO1</strong>&lt;br&gt;• The aridity index (AI) provides a numerical value to indicate the relative dryness of desert areas. (1)&lt;br&gt;• Some may offer a calculation for the index, eg AI = precipitation/potential evapotranspiration. Ranges can then be used to define sub categories within arid areas, eg arid and semi-arid. (1 + 1 with development)&lt;br&gt;• The aridity index can be used to indicate the native vegetation which can possibly inhabit a given area. (1)&lt;br&gt;• The aridity index is also important for crop cultivation in drylands. Higher than average precipitation and lower than average temperatures are best for limiting stress to crops. (1 + 1 with development)&lt;br&gt;• Changing aridity index measurements can be tracked to indicate the process of desertification, particularly in longitudinal studies. (1)</td>
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<thead>
<tr>
<th>02</th>
<th>2</th>
<th><strong>AO3</strong> – Responses should use the resources effectively and appropriately showing understanding of the maps and of the link between the three maps. Expect to see analysis patterns and identifies anomalies on the two maps showing data, using the third map for referencing desert areas.</th>
<th>AO3 = 6</th>
<th>6</th>
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<tbody>
<tr>
<td></td>
<td></td>
<td><strong>Level 2 (4–6 marks)</strong>&lt;br&gt;<strong>AO3</strong> – Clear analysis of the quantitative evidence provided, which makes appropriate use of evidence in support. Clear connection(s) between different aspects of the evidence.</td>
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<tr>
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<td></td>
<td><strong>Level 1 (1–3 marks)</strong>&lt;br&gt;<strong>AO3</strong> – Basic analysis of the quantitative evidence provided, which makes limited use of evidence in support. Basic connection(s) between different aspects of the evidence.</td>
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<td></td>
<td><strong>Notes for answers</strong>&lt;br&gt;<strong>AO3</strong>&lt;br&gt;• The largest desert area is found in north Africa and the Middle East. Here there is a mixed pattern in terms of expected outcome for precipitation rates. In summer this region is largely expected to experience no change or become drier. For example, in the west of the Sahara, rainfall is expected to fall by as much as 75% compared to the 1986-2005 average. There appears to be a small anomaly in the centre of the Sahara region, as precipitation is expected to increase by as much as 50%.&lt;br&gt;• In winter the Middle East is forecast to become drier, by as much 75%, but again the pattern is mixed with no change in</td>
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some parts.

- The desert in Australia is not expected to experience much change, perhaps a little drier in winter. However, for southwest Australia it is expected to see a 50% reduction in rainfall in summer for the period 2071-2100.
- The desert in south western Africa (Namibian), is expected to see a considerable reduction in precipitation in both summer and winter – up to 50%, but mostly between 50 and 75%.
- Overall analysis – for the vast majority of desert areas, by 2070, precipitation rates are expected to fall below what is already very low levels.

| 02 | 3 | \(\text{AO1} \) – Knowledge and understanding of the characteristics of hot desert environments and their margins: climate, soils and vegetation (and their interaction).
\[\text{AO2} \] – Application of knowledge and understanding to show how the desert climate and soils impact upon productivity in the area shown.

**Level 2 (4–6 marks)**

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

**Level 1 (1–3 marks)**

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

**Notes for answers**

- \(\text{AO1} \)
  - Knowledge and understanding of drylands which occur at all latitudes and are characterised by limited soil moisture caused by low precipitation and high evaporation.

- \(\text{AO2} \)
  - The decisive factor is the climate. Hot deserts experience very high temperatures for most of the year during day time, but also, during night time, very low temperatures. The sky is...
clear with little cloud cover, typical of deserts during the day. Precipitation levels are clearly very low as evidenced by the dry parched landscape and the cloudless skies.

- There is some evidence of weathering and this is mainly undertaken by mechanical processes.
- Soil formation is basic, with only thin soils evident. The vegetation is highly adapted to the environment. There is a lack of tree coverage, which is another clue about the lack of moisture.
- Expect to see reference to the characteristics of the Saguaro Cactus and named surrounding vegetation. In summary, the landscape created is one of low density vegetation, with species highly adapted to the climate and poor soils.
- Net primary productivity is low as indicated by the data in the table, Figure 4b. This, along with the low biomass data, should be correlated with the lack of vegetation cover in the image.

| AO1 | Knowledge and understanding of population pressures and natural changes affecting semi-arid and arid environments. |
| AO2 | Application of knowledge and understanding to examine the extent to which human activity and natural processes are causing detrimental impact upon semi-arid and arid environments. |

Notes for answers

AO1
- 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 changing extent and distribution of hot deserts over the last 10 000 years.
- The causes of desertification – climate change and 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.
- Potential use of a case study at a local scale of a landscape where desertification has occurred to illustrate and analyse key themes of desertification, causes and impacts, implications for sustainable development.
- Evaluation of human responses of resilience, mitigation and adaptation.

AO2
- There is ample evidence of population expansion in semi-arid environments. The Sahel is likely to feature in many responses. This area has experienced rapid population...
expansion. The population is estimated to be around 500 million people and has shown a 30% increase in population between 2000 and 2015.

- The Sahel is a vast belt extending across the width of the southern part of the Sahara Desert from Mauritania and Senegal in the west to Eritrea, Sudan and Ethiopia in the east. These are some of the poorest countries in the world. A lack of healthcare and birth control means that the population growth being experienced remains unabated. Whilst some countries are seeing a reduction in birth rates, it is not nearly rapid enough to reduce the overall population increases.

- Human activities in such environments are likely to relate to settlements, deforestation, energy consumption, farming and mining. Deforestation for fuel and crop/grazing land is likely to feature as a major factor contributing to the process. With no tree roots to shelter and bind the soils, erosion is a major problem.

- The natural changes related to the impact of climate change. Semi-arid environments are, in the main, expected to experience even drier and hotter conditions in the coming decades. Also, though the extent of semi-arid environments shows natural fluctuation and mirrors natural variations in annual rainfall in these regions. It is therefore reasonable to argue that the process of desertification is a natural one, though human activity certainly seems to be exacerbating this.

- The question invites some discussion of counter measures designed to conserve threatened areas. The main thrust of conservation is likely to relate to soil and water management. Expect to see reference to international organisations and aid agencies bringing intermediate technology. Schemes such as water spreading weirs, dam building, the use of grass strips, mulching and composting techniques are likely to feature.

- Others may consider measures to address the population resource imbalance through population control measures.

- Overall there is likely to be some acknowledgement of the scale of the challenges facing these communities and, whilst there are some mitigating actions in place, most are likely to argue in support of the thrust of the statement.
Marking grid for Question 2.4

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

- Eustatic change is a global change in sea level, whereas isostatic is a more localised/regional change of the land relative to the sea level. Tectonic change is also a local/regional scale change in the land relative to the sea level (1 +1 with development).
- Eustatic change is brought about by a global change in the sea level relative to the land. During an ice age, sea levels drop relative to the land. Isostatic change results from the local impact of ice upon the land for example as ice melts, the pressure release can cause an isostatic rebound whereby the land rises above the sea level at a local level. Tectonic change is brought about by tectonic activity usually at plate boundaries. This can cause dramatic and immediate changes to the land relative to the sea (1 +1 + 1 for development).
- Some may go further and make links to landforms by way of explanation, eg Eustatic change – Fjords, Isostatic change – raised beaches. Tectonic changes – formation of ridges or fold mountains. (1 +1 for development)

Max 3 marks if all three processes are not clearly distinguished.

AO3 – Detailed use of the map to link transport pathways to erosion and/or deposition in the development of the estuary.

Level 2 (4–6 marks)
AO3 – Clear analysis of the quantitative evidence provided, which makes appropriate use of evidence in support. Clear connection(s) between different aspects of the evidence.

Level 1 (1–3 marks)
AO3 – Basic analysis of the quantitative evidence provided, which makes limited use of evidence in support. Basic connection(s) between different aspects of the evidence.

Notes for answers

- The centre of the estuary to the south east is largely experiencing no change in terms of erosion or deposition. This means it is stable and becoming neither deeper nor more shallow. The main pathway for suspended load appears to be from the south east and is brought by the tide. This suggests the tide brings in more suspended load than the rivers move out of the estuary. Bed load joins this main channel from the three rivers – The Test, The Hamble and Southampton Water itself. This suggests that any suspended load being picked up and moved north west is compensated by the bed load moving south east.
- At both banks of Southampton Water, there is a net erosional
effect. In the north around Netley, suspended load predominantly moves into the centre of the channel. The area to the east of Hythe has suspended load moving towards the bank yet the dominant process is erosional.

- Moving towards the south west, the dominant process is depositional. As there is no bedload moving south east, it suggests the suspended load is settling here beyond the influence of any tidal currents.
- There is also longshore drift along the eastern bank of Southampton Water. This may account for the net erosion taking place there. However there an anomaly to the south east of Netley. Here the longshore drift appears to be moving south easterly.

<table>
<thead>
<tr>
<th>03</th>
<th>3</th>
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</table>
| **AO1** – Knowledge and understanding of the process of and factors affecting coastal erosion. The landforms associated with coastal erosion. 

AO2 – Application of this knowledge to the novel situation; specifically in accounting for the formation of Lulworth Cove and other features along this stretch of coastline. Clearly links the process to the development of the landscapes. |

**Level 2 (4–6 marks)**

AO1 – Demonstrates clear knowledge and understanding of concepts, processes, interactions and change.

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

**Level 1 (1–3 marks)**

AO1 – Demonstrates basic knowledge and understanding of concepts, processes, interactions, change.

AO2 – Applies limited knowledge and understanding to the novel situation offering only basic evaluation and analysis drawn from the context provided. Connections and relationships between different aspects of study are basic with limited relevance.

**Notes for answers**

AO1

- 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.
- 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
- Origin and development of landforms and landscapes of coastal deposition – Beaches – factors and processes in their development.
- The relationship between process, time, landforms and landscapes in coastal settings.

**AO2**
- The image is centred around Lulworth Cove on the Dorset coastline. This is cleared affected by erosion as the dominant coastal process.
- Hydraulic action, abrasion and attrition may be referenced as the likely cause of the development of the cliff lined coasts which also have a number of other erosional features such as bays and stacks.
- It is not possible to ascertain the height of the stack and it is reasonable to infer that weathering is also likely to be at play in reducing cliff line angles and shaping the sea stacks to the west (Mupe Rocks).
- There should be some acknowledgement of local geology in shaping this coastline. The concordant geology, running parallel to the coast, is a decisive factor in the creation of Lulworth Cove. The more resistant Portland Stone has been breached at some point in the past. Erosion has then attacked the Purbeck Limestone and Shales and the Wealden (marls with sandstone). Some may argue that the process is ongoing and that the chalk is now being eroded. Others may argue that the feature is now stable as the bay is shallow, sheltered and therefore protected from the main action of the waves/sea. Either position is acceptable as this is valid application of knowledge.
- Some may reference longshore drift as a process shaping the coastline. The eroded material has clearly been removed as there is little or no evidence of beach formations. However, to the east in Mupe Bay, a beach has clearly formed. This suggests that deposition of drift material is occurring here.

**Notes for answers**
There are clear inter-related strands to this question. The focus is upon the potential of coastal management to mitigate against flooding and erosion. The assertion is that natural processes and

<table>
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<tr>
<th>Score</th>
<th>AO1</th>
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<td>03</td>
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</table>

AO1 = 10
AO2 = 10

20
the impact of climate change can be controlled/managed by people. There is also an aspect of alternative possible futures. Responses should look ahead and integrate the changing coastal dynamic into their responses.

AO1

- A range of processes affecting coastlines. Expect to see reference to: waves (constructive and destructive); prevailing currents; the role of wind and its connection to fetch.
- Erosional processes and associated landforms – abrasion, attrition, hydraulic action and solution – landscapes of erosion may feature.
- Transportation processes of traction, saltation, solution and suspension. Links to longshore drift are likely. Some may connect wave action and longshore drift.
- Deposition should feature in relation to a variety of landforms such as beaches, dunes, spits and bars.
- The contribution of these processes (erosion, transport and deposition) to the development of low and high energy environments may also feature. Expect to see stronger focus upon high energy environments with links to erosional coastlines and those at risk of flooding.
- Coastal management strategies to include hard engineering, soft engineering and other approaches such as managed retreat.
- Alternative possible futures should emerge and include the potential impact of sea level change upon both process and landform, but also how this impacts upon attitudes to coastal management.
- Risks associated with living along coastlines under threat from erosion and flooding.
- Learned case study support may be used to exemplify.
- Many will use case studies from within the UK and beyond the UK in supporting their responses.

AO2

- Most will consider the evidence and assess the extent to which flooding and erosion are set to increase to unprecedented levels. It really depends on where responses choose to focus their argument.
- In the UK, expect to see reference to locations/coastlines such as Happisburgh. Here isostatic changes are combining with a eustatic rise in sea level to create significant risk of flooding and erosion. Also local geology is adding to the issue as the rocks are easily eroded. Added to this, the area is relatively close to sea level, just a few metres above.
- Equally though, there are numerous examples of well managed coastlines where erosion and flooding are not issues or where deposition is the dominant process. In Scotland for example, three quarters of its coastline is stable. Of the remaining quarter, 11% is accretional and 14% is erosional. Some may explore reasons for this such as the
Some debate is encouraged in relation to flooding. Some coastlines are coping relatively well with issues arising out of natural processes. Estuaries such as the Thames, with considerable financial investment in flood and erosion defence schemes, are well protected against the natural processes threatening it. However, further abroad, some may consider locations such as the Maldives, whose very existence is under threat as a result of sea level change. The highest point of the Maldives is only 8 m above sea level.

Evaluation – some may engage in a debate around the value of intervention. Responses are likely to consider the challenges of defending coastal locations in a financial climate of scarce resources. Policy dilemmas associated cost and options such as with managed retreat are likely to feature. This may be linked to the ‘knock-on effects’ of intervention in natural processes. Interference in the movement of beach material in sediment cells is credited with causing considerable issues in places where no management exists.

Some students may use recent storm events as part of a case study to exemplify the impact on the local area and how these events are forecast to increase in frequency and severity as a result of climate change. This is one alternative possible future associated with increased flooding.

Some may suggest that impacts of climate change are minimal due to the actions of people in mitigation. For example, mitigation against the impact of sea level rise in the Maldives through a combination of hard and soft engineering strategies, such as the development of mangrove and the hard engineering work taking place around the island’s economic hubs, such as the capital, Malé.

Whilst any position is acceptable with reasoned argument, overall evaluation is likely to acknowledge that coastal management is set to become an increasingly challenging issue for governments around the world over the coming decades. Whilst it is possible to interfere with natural processes, human induced climate change and the scarcity of financial resources make decisions about where to protect and how much to invest extremely difficult. Places such as the Maldives have no real viable future if the climate models and expected sea level changes emerge. Other places such as the Netherlands have managed to fight these natural processes with massive financial investment and considerable technological advancement.
## Marking grid for Question 3.4

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

<table>
<thead>
<tr>
<th>Level 0</th>
<th>Nothing worthy of credit.</th>
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</table>
AO1
Responses may consider diverse vegetation types such as alpine vegetation, taiga (boreal forest) or tundra.
• The vegetation in cold environments is highly adapted to the cold conditions, the low levels of precipitation (in some places) and the long periods with low levels of insolation. (1 + 1 with development) Max 2 for generic reference to adaptation.
• Eg for the Taiga, there is a limited species diversity due the extreme climate especially in winter (1). Coniferous trees dominate the landscape. The waxy needles give protection from freezing temperatures and from drying out (1). They are evergreen to allow as much photosynthesis to take place as possible. This is due to the very short growing season (1 + 1 with development). The needles are also dark in colour allowing them to absorb heat from the sun (1 mark). Evergreens in the Taiga tend to be thin and grow close together. This gives them protection from the cold and wind (1). Evergreens also have branches pointing towards the ground in order to protect them from breaking under the weight of snow (1).

AO3 – Uses graphical skills to interpret and analyse data. Uses the remote sensed image and graphs in conjunction with each other to draw appropriate analysis of the characteristics of the solifluction lobe.

Level 2 (4–6 marks)
AO3 – Clear analysis and interpretation of the quantitative evidence provided, which makes appropriate use of data in support. Clear connection(s) between different aspects of the data and evidence.

Level 1 (1–3 marks)
AO3 – Basic analysis and interpretation of the quantitative evidence provided, which makes limited use of data and evidence in support. Basic connection(s) between different aspects of the data and evidence.

Notes for answers
AO3
• The solifluction lobe is around 600-700 metres in length (Figure 8a) depending on where measurement is taken from.
• It is about 250-300 metres wide at its widest point (Figure 8a).
• It is possible to estimate the depth of the lobe by subtracting the distance between line A and B (Figure 8b) at the widest point. This occurs around 280 metres along the profile and gives an estimated maximum height of around 15 metres (Figure 8b). This is the difference between the line A which
is taken through the mid-point of the lobe and line B which is the normal cross profile of the valley side (Figure 8b).
- The lobe is around 100 metres away from the Dalton Highway and 250 metres away from the Trans-Alaskan Pipeline System (Figure 8a).
- The lobe emerges at an elevation of around 628 metres with the snout ending at an elevation of around 550 metres. This suggests the lobe covers 78 metres of elevation from sea level (Figure 8b).
- The lobe has a degree of symmetry but is not wholly symmetrical. In its lower reaches, it appears to shift to the left (south) looking down the lobe (Figure 8c).

<table>
<thead>
<tr>
<th>AO1</th>
<th>AO2</th>
<th>Level 2 (4–6 marks)</th>
<th>Level 1 (1–3 marks)</th>
<th>Notes for answers</th>
</tr>
</thead>
</table>
|     |     | AO1 – Demonstrates knowledge and understanding of the factors affecting the development of solifluction lobes. Periglacial features and processes: permafrost, active layer and mass movement. | AO1 – Demonstrates basic knowledge and understanding of concepts, processes, interactions and change. | AO1 = 2  
AO2 = 4 |
|     |     | AO2 – Applies knowledge and understanding to this novel situation by suggesting reasons for the development of this Alaskan landscape feature. | AO2 – Applies limited knowledge and understanding to the novel situation offering only basic evaluation and analysis drawn from the context provided. Connections and relationships between different aspects of study are basic with limited relevance. | |
| 04  | 3   | Level 2 (4–6 marks) | Level 1 (1–3 marks) |

**AO1**
- Periglacial features and processes: permafrost, active layer and mass movement.
- Periglacial landforms: patterned ground, ice wedges, pingos, blockfields, solifluction, lobes, terracettes, thermokarst. Characteristic periglacial landscapes.
- The relationship between process, time, landforms and landscapes in glaciated settings: characteristic glaciated and periglacial landscapes.
AO2

- The solifluction lobe appears to have emanated from what looks like a previously glaciated corrie or a nivation hollow. Weathered and previously eroded material has collected in the circular hollow on the hillside.
- Over time the soil and vegetation has developed in the landscape suggesting that warming has occurred and that this now a periglacial area as opposed to an alpine glacial area. Repeated freezing and thawing adds material to the lobe in the form of scree.
- The thawing of the active layer on the slope leads to the process of solifluction. The shear zone indicated more rapid active layer detachment basal sliding perhaps taking place over a relatively short period of time. It marks a point of steep decent on the hill slope.
- As the lobe develops, it forces its way downslope, burying and destroying the vegetation in its path. This accounts for the drunken trees and split trees further downslope.
- The top of the lobe moves faster than the base further accounting for the shear zones and also accounting for the reduction in size of the lobe at its snout.
- There is no indication that the lobe will stop moving on to the Dalton Highway as this is still a relatively steep slope. It is gravity along with the thawed, moisture lubricated soil, vegetation and rock debris, which is causing the movement.

AO1 – Knowledge and understanding of process and landforms in fluvio-glacial environments.

AO2 – Applies knowledge and understanding to the context of the question in assessing the impact of human activity upon the dynamic equilibrium in cold environments.

Notes for answers

AO1

- Geomorphological processes – weathering: frost action, nivation; ice movement: internal deformation, rotational, compressional, extensional and basal sliding; erosion: plucking, abrasion; transportation and deposition.
- Fluvial processes: meltwater, erosion, transportation and deposition.
- Periglacial features and processes: permafrost, active layer and mass movement.
- Origin and development of landforms and landscapes of glacial deposition: drumlins, erratics, moraines, till plains. Characteristic glaciated landscapes.
- Fluvial landforms of erosion and deposition: meltwater channels, kames, eskers, outwash plains. Characteristic fluvial landscapes.
- Periglacial landforms: patterned ground, ice wedges, pingos, blockfields, solifluxion, lobes, terracettes, thermokarst. Characteristic periglacial landscapes.
- Concept of environmental fragility. Human impacts on fragile cold environments over time and at a variety of scales. Recent and prospective impact of climate change.

**AO2**

- The basic assertion of the statement is that periglacial areas are likely to experience the most significant change as a result of climate change and its subsequent impact upon the dynamic equilibrium. It stands to reason that the extent of fluvioglacial areas is set to increase. As ablation exceeds accumulation in valley glaciers there will be an inevitable growth in and coverage of fluvioglacial landscapes.
- Other human activity may also be considered. As the climate warms, human encroachment into periglacial areas is likely to continue. Put simply these locations are likely to become more habitable and therefore more vulnerable. Some may consider the impact on natural vegetation for example.
- With more meltwater (at least in the short term) these areas are likely to experience more flooding downstream and erosion of the previously sorted sediments in the outwash plains. This could see the eventual removal of what have been some extremely stable landform features in fluvioglacial areas. The increased sediment carried away may also have further consequences downstream.
- Also with higher temperatures, more extensive melting and rainfall mixed in with meltwater will inevitably lead to much greater risk of flooding. This is already the case in areas such as the Himalayas. Glacial retreat in this region is impacting the hydrological processes in the Tibetan Plateau and surrounding regions. The glacial retreat has caused an increase of more than 5.5% in river runoff from the plateau in recent years. In some areas, such as the Tarim River basin, the increase in river runoff is greater. Glacial retreat has also caused rising lake levels in the areas with large coverage of glaciers, such as the Nam Co Lake and Selin Co Lake areas. Rising lake levels are devastating grasslands and villages near the lakes.
- Responses are also expected to challenge the assertion of statement. Many will argue that it is the alpine glacial areas which are at greatest threat or perhaps the great sheet glaciers in polar regions which are already experiencing rapid change.
- Whichever approach the response takes, there should be clear engagement with the impact of human activity upon the natural environment.
Marking grid for Question 4.4

<table>
<thead>
<tr>
<th>Level/Mark range</th>
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<td>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).</td>
</tr>
<tr>
<td><strong>(16–20 marks)</strong></td>
<td>Detailed, coherent and relevant analysis and evaluation in the application of knowledge and understanding throughout (AO2).</td>
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<td></td>
<td>Full evidence of links between knowledge and understanding to the application of knowledge and understanding in different contexts (AO2).</td>
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<tr>
<td></td>
<td>Detailed, highly relevant and appropriate knowledge and understanding of place(s) and environments used throughout (AO1).</td>
</tr>
<tr>
<td></td>
<td>Full and accurate knowledge and understanding of key concepts, processes and interactions and change throughout (AO1).</td>
</tr>
<tr>
<td></td>
<td>Detailed awareness of scale and temporal change which is well integrated where appropriate (AO1).</td>
</tr>
<tr>
<td><strong>Level 3</strong></td>
<td>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).</td>
</tr>
<tr>
<td><strong>(11–15 marks)</strong></td>
<td>Generally clear, coherent and relevant analysis and evaluation in the application of knowledge and understanding (AO2).</td>
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<td>Generally clear evidence of links between knowledge and understanding to the application of knowledge and understanding in different contexts (AO2).</td>
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<td></td>
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</tr>
<tr>
<td><strong>Level 2</strong></td>
<td>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.</td>
</tr>
<tr>
<td><strong>(6–10 marks)</strong></td>
<td>Some partially relevant analysis and evaluation in the application of knowledge and understanding (AO2).</td>
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<td>Some evidence of links between knowledge and understanding to the application of knowledge and understanding in different contexts (AO2).</td>
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<td></td>
<td>Some relevant knowledge and understanding of place(s) and environments which is partially relevant (AO1).</td>
</tr>
<tr>
<td></td>
<td>Some knowledge and understanding of key concepts, processes and interactions and change. There may be a few inaccuracies (AO1).</td>
</tr>
<tr>
<td></td>
<td>Some awareness of scale and temporal change which is sometimes integrated where appropriate. There may be a few inaccuracies (AO1).</td>
</tr>
<tr>
<td><strong>Level 1</strong></td>
<td>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.</td>
</tr>
<tr>
<td><strong>(1–5 marks)</strong></td>
<td>Very limited analysis and evaluation in the application of knowledge and understanding. This lacks clarity and coherence (AO2).</td>
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<tr>
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<td>Very limited and rarely logical evidence of links between knowledge and understanding to the application of knowledge and understanding in different contexts (AO2).</td>
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<td>Very limited relevant knowledge and understanding of place(s) and environments (AO1).</td>
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<tr>
<td></td>
<td>Isolated knowledge and understanding of key concepts, processes and interactions and change. There may be a number of inaccuracies. (AO1).</td>
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</table>
• Very limited awareness of scale and temporal change which is rarely integrated where appropriate. There may be a number of inaccuracies (AO1).

| Level 0 (0 marks) | Nothing worthy of credit. |
### Section C

<table>
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<td>C</td>
<td>AO1</td>
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<td>4</td>
<td>D</td>
<td>AO1</td>
<td>1</td>
</tr>
<tr>
<td>05</td>
<td>5</td>
<td>AO3 – There are two resources to use in conjunction with each other. The skills relate to graphical interpretation and analysis of tabular data. Analysis relates to identification of pattern and trends as well as anomaly.</td>
<td>AO3 = 6</td>
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</tbody>
</table>

**Level 2 (4–6 marks)**

**AO3** – 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.

**Level 1 (1–3 marks)**

**AO3** – 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.

**Notes for answers**

**AO3**

- The data provides some conflicting information with careful analysis.
- There is a broad correlation between SST and PDI in Figure 10. It suggests that as sea surface temperature increases, the power, frequency and duration of hurricanes also increases proportionately (and vice versa).
- There is a clear oscillation of SST. It ranges between 27.5 and 28.4°C. The peaks and troughs of SST and PDI broadly correlate. This is a positive relationship. When SST is high, so too is PDI, and vice versa.
- This may be exemplified. For example, in 1980 there is an almost perfect correlation between increases in SST and proportionate increases in PDI. When SST peaks at 27.8°C, PDI peaks at around 3. Similar examples occur in 1988, 1997 and 2005 (approximately). The troughs also show clear correlation, though this is less secure. The closest match...
occurs around 1973 when SST dropped to around 27.42°C and PDI dropped to around 1.4.

- Further back in time there is less clarity in terms of the relationship. Between 1950 and 1970, there is even evidence of an inverse relationship. For example, in 1977, SST was around 27.82°C but PDI was only around 2.2.
- **Figure 11** casts even further doubt over the relationship. Whilst this data only looks at hurricane frequency and severity by decade, there is no evidence to suggest increasing regularity or severity with the passage of time (and associated gradual increase in mean SST).

<table>
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<tr>
<th>05</th>
<th>6</th>
<th>AO1 – Knowledge and understanding of a range of impacts of volcanic hazards as well as the challenges associated with management of major events.</th>
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<td><strong>AO2</strong> – Application of knowledge and understanding to this novel situation. The resources provide clues as to the impacts of the hazards, but the correct thrust of the response is around the challenges associated with managing the events.</td>
</tr>
</tbody>
</table>

**Level 3 (7–9 marks)**

**AO1** – Demonstrates detailed knowledge and understanding of concepts, processes, interactions and change. These underpin the response throughout.

**AO2** – Applies knowledge and understanding appropriately with detail. Connections and relationships between different aspects of study are fully developed with complete relevance. Analysis and evaluation are detailed and well supported with appropriate evidence.

**Level 2 (4–6 marks)**

**AO1** – Demonstrates clear knowledge and understanding of concepts, processes, interactions and change. These are mostly relevant though there may be some minor inaccuracy.

**AO2** – Applies clear knowledge and understanding appropriately. Connections and relationships between different aspects of study are evident with some relevance. Analysis and evaluation are evident and supported with clear and appropriate evidence.

**Level 1 (1–3 marks)**

**AO1** – Demonstrates basic knowledge and understanding of concepts, processes, interactions and change. This offers limited relevance with inaccuracy.

**AO2** – Applies limited knowledge and understanding. Connections and relationships between different aspects of study are basic with limited relevance. Analysis and evaluation are basic and supported with limited appropriate evidence.
Notes for answers
The direction of the response largely depends upon the argument that the student wishes to put forward.

AO1
- 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. Impacts: primary/secondary, environmental, social, economic, political.
- Short and long-term responses: risk management designed to reduce the impacts of the hazard through preparedness, mitigation, prevention and adaptation.
- Impacts and human responses as evidenced by a recent volcanic event.
- Characteristic human responses – fatalism, prediction, adjustment/adaptation, mitigation, management, risk sharing – and their relationship to hazard incidence, intensity, magnitude, distribution and level of development.

AO2
- There are many challenges indicated by the data presented. These relate to both scale and managing the impact of eruptions over time.
- **Figure 12** and **Figure 13** both point towards the climatic impact of eruptions. The data suggests that a major eruption is capable of leading to significant climate change; namely a drop in temperature but also an impact upon precipitation levels. Responses could infer that a fall in temperature could lead to lower evaporation rates which in turn may affect precipitation rates, depending upon location.
- Responding to the scale of this challenge would be extremely difficult as there would be significant impact on food production as a result of global cooling. A major eruption is likely to require a sustaining international effort in order to address food and water shortages.
- There is also a temporal and spatial dimension to this a major eruption. The historical data shows that eruptions can occur in many places, not just within the Ring of Fire for example. There are also significant time periods between the very major eruptions, but also an inevitability that the ‘big one’ is coming.
- Whilst there are almost always short term clues that an eruption is coming, where and when this will occur is a major planning challenge for international agencies.
- **Figure 14** covers a range of short, medium and longer term impacts. Whilst the resource has some limitations, it does clearly suggest a range of widespread and severe impacts ranging from short term disaster management and also
longer term planning issues. The disruption to air travel, experienced after the Eyjafjallajökull eruption of 2010 is a good case in point to which some may refer. Managing the short term/high cost impact of this event proved extremely costly, most notably due to the grounding of all air travel within the exclusion zone due to the fine dust particles impacting upon jet engines.

- The response should be clearly focused upon the management challenges and not a prolonged description of the impacts.

| 05 | 7 | AO1 – Knowledge and understanding of the hazard management cycle. Knowledge and understanding of the response to wildfire. AO2 – Application of knowledge and understanding in evaluating the extent to which this theoretical model can assist in planning for the management of wildfire events. **Level 3 (7–9 marks)** AO1 – Demonstrates detailed knowledge and understanding of concepts, processes, interactions and change. These underpin the response throughout. AO2 – Applies knowledge and understanding appropriately with detail. Connections and relationships between different aspects of study are fully developed with complete relevance. Analysis and evaluation is detailed and well supported with appropriate evidence. **Level 2 (4–6 marks)** AO1 – Demonstrates clear knowledge and understanding of concepts, processes, interactions and change. These are mostly relevant though there may be some minor inaccuracy. AO2 – Applies clear knowledge and understanding appropriately. Connections and relationships between different aspects of study are evident with some relevance. Analysis and evaluation evident and supported with clear and appropriate evidence. **Level 1 (1–3 marks)** AO1 – Demonstrates basic knowledge and understanding of concepts, processes, interactions and change. This offers limited relevance with inaccuracy. AO2 – Applies limited knowledge and understanding. Connections and relationships between different aspects of study are basic with limited relevance. Analysis and evaluation basic and supported with limited appropriate evidence. | AO1 = 4 AO2 = 5 | 9 |
Notes for answers

AO1

- Nature of wildfires. Conditions favouring intense wild fires: vegetation type, fuel characteristics, climate and recent weather and fire behaviour.
- Causes of fires: natural and human agency.
- Impacts: primary/secondary, environmental, social, economic, political.
- Short and long-term responses; risk management designed to reduce the impacts of the hazard through preparedness, mitigation, prevention and adaptation.
- Impact and human responses as evidenced by a recent wild fire event.

AO2

- Responses will bring a variety of variations upon the Hazard Management Cycle. Some will refer to the Disaster Management Cycle. This is acceptable and should be credited.
- The cycle provides a framework within which management of wildfire comfortably sits. The model operates within key elements – Preparation/Response/Recovery/Mitigation.
- Many will argue that preparation requires an understanding of the cause of wildfire as well as an understanding of the typical locations where wildfire tends to occur.
- The causes are well documented. Natural causes relate to lightning strikes, volcanic eruptions and even sparks from a rockfall. There is also some evidence that wildfire can be started by spontaneous combustion. Human causes can be categorised as either intentional or accidental. Carelessness with camp fire and cigarettes are the main accidental causes. Some will point out that intentional fire starting is very difficult to plan for because of its random nature. However, without a fuel source, there can be no wildfire.
- Expect to see reference to hazard mapping as part of preparation for wildfire. This is used to map areas most at risk using a variety of data on vegetation type and coverage, precipitation rates, weather forecasting and historical records.
- The model also proves useful around managing the response. For wildfire, the use of water is a major factor in the response. The aim is to put out the fire as soon as possible. There are a variety of techniques and some overlap with preparation in this regard. For example, ensuring a substantial supply of water is readily available in affected areas is key. Also for response, planners will have established protocols around the use of fire lines which are measures taken to remove vegetation and isolate the fire.
In terms of recovery, a major factor relates to the risk of soil erosion. Exposed soil can be easily eroded by the action of wind and heavy rainfall. Expect to see reference to measures designed to protect the soil such as straw coverage or using partially burned vegetation to cover the soil. There is also the added risk of mudflow where the burning occurred on a hillside. Stabilising such slopes is another part of recovery.

Mitigation is the final strand of the cycle. In terms of wildfire this is about reducing the risk to property and the environment. There is overlap here with preparation and response. Mitigation may involve using fire retardant/resistant building materials for example.

In terms of evaluation, some may suggest that this model is a little basic. Whilst it does provide a framework, it lacks the sophistication of the Park Model. Some may suggest that this model is much more centred around the human impacts and therefore useful in shaping the response. It includes a temporal dimension and charts the recovery back to normal quality of life and levels of economic activity in the area following a disaster.

| AO1 – Knowledge and understanding of plate tectonics. Knowledge and understanding of the nature and cause of volcanic events. |
| AO2 – Application of knowledge and understanding in analysis and evaluation of the extent to which plate tectonic theory can assist in developing understanding of the nature and causes of volcanic activity. |

**Notes for answers**

**AO1**

- Earth structure and internal energy sources. Plate tectonic theory of crustal evolution: tectonic plates; plate movement; gravitational sliding; ridge push, slab pull; convection currents and sea-floor spreading.
- Destructive, constructive and conservative plate margins. Characteristic processes: seismicity and vulcanicity. Associated landforms: young fold mountains, rift valleys, ocean ridges, deep sea trenches and island arcs, volcanoes.
- Magma plumes and their relationship to plate movement.
- 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.

**AO2**

- Plate tectonic theory provides powerful support in aiding understanding of the causes of vulcanicity. However hot spots and the formation of island chains such as the Hawaiian Island chain provide evidence that plate tectonics is
not a complete theory.

- There should be clear links to the established theory around the cause of vulcanicity.
- Expect to see reference to magma plumes and concepts associated with convection currents.
- There should also be reference to diverse types of plate boundary and how these produce different types of volcano. Composite cone and shield volcanoes may feature here.
- In terms of nature, expect to see reference to a range of volcano types and how these relate to diverse types of lava. Rhyolitic and andesitic lava types may feature here.
- Some may consider the types of eruption which relate to the different volcanoes. Whilst the question is not strictly about hazards, provided the response links the eruption to the plate tectonic theory, then this is a valid approach.
- Hot spot theory may also feature. Expect to see this used to explain the formation of the Hawaiian chain but also to challenge the idea that volcanoes only occur on plate boundaries.
- Whatever the approach there should be some critical engagement with the theory and how it supports understanding of the development of vulcanicity.
- Case study support may feature to show contrasting volcanic activity around the world. Again provided this is used in the context of plate tectonic theory, this is a valid approach.
## Marking grid for Question 5.8

<table>
<thead>
<tr>
<th>Level/Mark range</th>
<th>Criteria/Descriptor</th>
</tr>
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</table>
| **Level 4**
(16–20 marks) | - Detailed evaluative conclusion that is rational and firmly based on knowledge and understanding which is applied to the context of the question. Interpretations are comprehensive, sound and coherent (AO2).
- Detailed, coherent and relevant analysis and evaluation in the application of knowledge and understanding throughout (AO2).
- Full evidence of links between knowledge and understanding to the application of knowledge and understanding in different contexts (AO2).
- Detailed, highly relevant and appropriate knowledge and understanding of place(s) and environments used throughout (AO1).
- Full and accurate knowledge and understanding of key concepts, processes and interactions and change throughout (AO1).
- Detailed awareness of scale and temporal change which is well integrated where appropriate (AO1). |
| **Level 3**
(11–15 marks) | - Clear evaluative conclusion that is based on knowledge and understanding which is applied to the context of the question. Interpretations are generally clear and support the response in most aspects (AO2).
- Generally clear, coherent and relevant analysis and evaluation in the application of knowledge and understanding (AO2).
- Generally clear evidence of links between knowledge and understanding to the application of knowledge and understanding in different contexts (AO2).
- Generally clear and relevant knowledge and understanding of place(s) and environments (AO1).
- Generally clear and accurate knowledge and understanding of key concepts, processes and interactions and change (AO1).
- Generally clear awareness of scale and temporal change which is integrated where appropriate (AO1). |
| **Level 2**
(6–10 marks) | - Some sense of an evaluative conclusion partially based upon knowledge and understanding which is applied to the context of the question (AO2). Interpretations are partial but do support the response in places.
- Some partially relevant analysis and evaluation in the application of knowledge and understanding (AO2).
- Some evidence of links between knowledge and understanding to the application of knowledge and understanding in different contexts (AO2).
- Some relevant knowledge and understanding of place(s) and environments which is partially relevant (AO1).
- Some knowledge and understanding of key concepts, processes and interactions and change. There may be a few inaccuracies (AO1).
- Some awareness of scale and temporal change which is sometimes integrated where appropriate. There may be a few inaccuracies (AO1). |
| **Level 1**
(1–5 marks) | - Very limited and/or unsupported evaluative conclusion that is loosely based upon knowledge and understanding which is applied to the context of the question (AO2). Interpretation is basic.
- Very limited analysis and evaluation in the application of knowledge and understanding. This lacks clarity and coherence (AO2).
- Very limited and rarely logical evidence of links between knowledge and understanding to the application of knowledge and understanding in different contexts (AO2).
- Very limited relevant knowledge and understanding of place(s) and environments (AO1).
- Isolated knowledge and understanding of key concepts, processes and interactions and change. There may be a number of inaccuracies. (AO1). |
<table>
<thead>
<tr>
<th>Level 0 (0 marks)</th>
<th>Nothing worthy of credit.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Very limited awareness of scale and temporal change which is rarely integrated where appropriate. There may be a number of inaccuracies (AO1).</td>
</tr>
</tbody>
</table>
AO3 – Analysis of data from the map and graphs in order to assess changes taking place the Great Barrier Reef (GBR).

**Level 2 (4–6 marks)**

AO3 – Clear analysis of the quantitative evidence provided, which makes appropriate use of data in support. Clear connection(s) between different aspects of the data and evidence.

**Level 1 (1–3 marks)**

AO3 – Basic analysis of the quantitative evidence provided, which makes limited use of data and evidence in support. Basic connection(s) between different aspects of the data and evidence.

**Notes for answers**

**AO3**

- In broad terms, the north and south regions of the GBR have the greatest coverage of coral. In the south for example, there is 29.2 to 46.7% coverage (Figure 15). The central region has the lowest percentage coverage, especially nearer the coast with figures as low as 11.5% coverage.

- In terms of the sample sites, there is no overall pattern evident. It is not possible to state for example that the areas with the greatest coverage are also growing. Even in the places with the least coverage in the centre, coral is experiencing growth in several places.

- The graphical data provided in Figure 16, offers further contextual information beyond the scope of Figure 15. Overall, coral coverage is in serious decline from around 27% average coverage to around 8% according the GBR data. The main causes of mortality are the Crown of Thorns Starfish (COTS) and Cycones. Bleaching appears to be only a periodic issue affecting the coral between 1997 and 2003.

- Within the reef there are considerable variations. The north for example appears to have experienced significant fluctuation but between 1985 and 2010 overall coverage has remained stable. It also appears to be least affected by the major causes of coral mortality. There is one anomaly in the north in 2003, where bleaching appears to have destroyed over 5% of the coral coverage.
Both the centre and south have experienced rapid decline. However, the south in particular has seen coverage almost completely eradicated from around 35% in 2003 to only 7% in 2010.

The overall picture for coral in the GBR is one of severe decline in the face of three major threats.

<table>
<thead>
<tr>
<th>06</th>
<th>6</th>
<th><strong>AO1</strong> – Knowledge and understanding of the concepts of biodiversity and sustainability as well as management issues in tropical rainforests.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td><strong>AO2</strong> – Application of knowledge and understanding to the novel situation. With declining rainforest coverage, there should be appreciation of the need for international co-operation and strategies to reverse the decline in biodiversity and overall forest coverage while still providing economic opportunities for local people.</td>
</tr>
</tbody>
</table>
|    |    | **Level 3 (7–9 marks)**  
**AO1** – Demonstrates detailed knowledge and understanding of concepts, processes, interactions and change. These underpin the response throughout.  
**AO2** – Applies knowledge and understanding appropriately with detail. Connections and relationships between different aspects of study are fully developed with complete relevance. Evaluation is detailed and well supported with appropriate evidence. |
|    |    | **Level 2 (4–6 marks)**  
**AO1** – Demonstrates clear knowledge and understanding of concepts, processes, interactions and change. These are mostly relevant though there may be some minor inaccuracy.  
**AO2** – Applies clear knowledge and understanding appropriately. Connections and relationships between different aspects of study are evident with some relevance. Evaluation evident and supported with clear and appropriate evidence. |
|    |    | **Level 1 (1–3 marks)**  
**AO1** – Demonstrates basic knowledge and understanding of concepts, processes, interactions and change. This offers limited relevance with inaccuracy.  
**AO2** – Applies limited knowledge and understanding. Connections and relationships between different aspects of study are basic with limited relevance. Evaluation basic and supported with limited appropriate evidence. |
|    |    | **Notes for answers**  
**AO1**  
- The concept of biodiversity. Local and global trends in biodiversity. Causes, rates and potential impacts of declining |
biodiversity.

- Factors influencing the changing of ecosystems, including climate change and human exploitation of the global environment.
- The nature of tropical rainforest to include:
  - the main characteristics of the biome
  - ecological responses to the climate, soil and soil moisture budget – adaptations by flora and fauna
  - human activity and its impact on the biome
  - typical development issues in the biome to include changes in population, economic development,
  - agricultural extension and intensification, implications for biodiversity and sustainability

AO2

- The data provides the opportunity for some debate. **Figure 17** suggests that the rate of deforestation is declining. This is not entirely consistent though. Both Peru and Bolivia present anomalies in that they now take up a much greater share of deforestation rates.
- This, to a degree conflicts with **Figure 18**. This suggests a significant reduction in rainforest in 2010. Whilst Bolivia has a large amount of ‘non-forest’, actual deforested areas are relatively small. This is even less the case for Venezuela. It is Brazil where most of the Amazonian forest appears to have been removed.
- In terms of sustainability there should be some appreciation that the forest has to be part of a development plan which allows economic exploitation for the government and people affected. So, whilst rates of deforestation appear to be reducing, the forest is still disappearing at an alarming rate. This suggests conservation strategies are not effective or that the needs of the farming community, miners or developers are being given greater voice than those seeking to preserve the integrity of the forest.
- International co-operation (or the lack of it) should also feature in responses. The fact that Bolivia and Peru have shown relative acceleration of the deforestation processes, suggests that there is a lack of regional agreement. It could even be argued that Bolivia and Peru are exploiting the shortage in supply of wood and associated products caused by the declining deforestation rates in Brazil. This clearly challenges any notion of long term sustainability of the Amazon rainforest.
- Biodiversity should also feature. Much of the interior of the forest remains intact according to **Figure 18**. Some may make the connection to virgin forest and higher levels of biodiversity in these locations. If agreements can be reached between governments and various interested parties such as ranchers, plantation owners and mining corporations, there is every chance that biodiversity can be retained in large protected swathes of forest. This could allow the development of other areas for such activities and it could
also include the replanting of secondary forest.

<table>
<thead>
<tr>
<th>AO1</th>
<th>AO2</th>
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<tbody>
<tr>
<td>Knowledge and understanding of the concept of succession. Knowledge and understanding of seral stage development in a hydrosere or lithosere.</td>
<td>Application of knowledge and understanding to analyse how arresting factors lead to the development of a sub-climax vegetation community.</td>
</tr>
</tbody>
</table>

**Level 3 (7–9 marks)**

AO1 – Demonstrates detailed knowledge and understanding of concepts, processes, interactions and change. These underpin the response throughout.

AO2 – Applies knowledge and understanding appropriately with detail. Connections and relationships between different aspects of study are fully developed with complete relevance. Analysis is detailed and well supported with appropriate evidence.

**Level 2 (4–6 marks)**

AO1 – Demonstrates clear knowledge and understanding of concepts, processes, interactions and change. These are mostly relevant though there may be some minor inaccuracy.

AO2 – Applies clear knowledge and understanding appropriately. Connections and relationships between different aspects of study are evident with some relevance. Analysis is evident and supported with clear and appropriate evidence.

**Level 1 (1–3 marks)**

AO1 – Demonstrates basic knowledge and understanding of concepts, processes, interactions and change. This offers limited relevance with inaccuracy.

AO2 – Applies limited knowledge and understanding. Connections and relationships between different aspects of study are basic with limited relevance. Analysis is basic and supported with limited appropriate evidence.

**Notes for answers**

AO1
- Nature of ecosystems – their structure, energy flows, trophic levels, food chains and food webs.
- Application of systems concepts to ecosystems – inputs, outputs, stores and transfers of energy and materials. Concepts of biomass and net primary production.
- Concepts of succession: seral stages, climatic climax, sub-climax and plagioclimax.
- Mineral nutrient cycling.
- Nature of terrestrial ecosystems and the inter-connections between climate, vegetation, soil and topography which...
produce them. Ecosystem responses to changes in one or more of their components or environmental controls.

- Factors influencing the changing of ecosystems, including climate change and human exploitation of the global environment.
- Succession and climatic climax as illustrated by lithoseres and hydroseres.
- The main characteristics of a distinctive local ecosystem (such as a pond or a dune system). Ecological responses to the climate, soil and soil moisture budget – adaptations by flora and fauna.

AO2

- The key point to make here is that sub-climax occurs because of natural arresting factors. These occur because of repeated fire or flood or other conditions which prevent the ecosystem from reaching its natural climatic climax.
- Expect to see exemplification in support of responses. Surtsey for example is likely to feature in many responses. It formed as a result of volcanic eruption on the constructive plate margin of the Mid-Atlantic Ridge. By 1963 the island had emerged but was bereft of any vegetation.
- In the first years following creation of the Island, lichen colonisation was in areas where steam condensed directly onto the lava. The first nesting gulls were found on Surtsey in 1986 and the numbers increased in the following years, resulting in dense colonies. There are various lichens which are commonly found in the excrement-rich roosting areas and the establishment of permanent bird colonies created suitable habitats on Surtsey for such lichens.
- A thin soil layer formed on the lava blocks in some of the bird roosting areas and these were colonised by soil inhabiting lichens. Soil also allowed the establishment of various plants, especially grasses. Competition has led to a decrease in some of the lichens that initially colonised soil areas.
- The main arresting factor is the coastal erosion and extremely harsh conditions on the island. Only the hardiest of species have been successful in colonising the island. Also, the relative remoteness of the island means that wind is the only natural means by which vegetation can colonise. Nesting birds have become a factor in bringing in new vegetation species but the harsh conditions and poorly developed soils mean that few can take hold.
- By 2008, 69 species of plant had been found on Surtsey of which about 30 had become established. This compares to the approximately 490 species found on mainland Iceland. However, more species continue to arrive, at a typical rate of roughly 2–5 new species per year. Some may therefore argue that Surtsey is currently a sub-climax community but in time will reach climatic climax.
AO1 – 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 fragility.

AO2 – Application of knowledge and understanding to evaluate the extent to which the savanna is a fragile environment.

Notes for answers

AO1

• The concept of biodiversity. Local and global trends in biodiversity. Causes, rates and potential impacts of declining biodiversity.
• Ecosystems and their importance for human populations in the light of continuing population growth and economic development. Human populations in ecosystem development and sustainability.
• The nature of savanna grassland to include:
  • the main characteristics of each biome
  • ecological responses to the climate, soil and soil moisture budget – adaptations by flora and fauna
  • human activity and its impact on each biome
  • typical development issues in each biome to include changes in population, economic development, agricultural extension and intensification, implications for biodiversity and sustainability
• Local factors in ecological development and change (such as agriculture, urban change, the planned and unplanned introduction of new species).
• The impacts of change and measures to manage these impacts. Conservation strategies and their implementation in specific settings.

AO2

• Expect responses to address the issue of fragility. It could be argued that the savanna is a fragile environment. It relies on seasonal rains which have been inconsistent in recent years. Drought is a major threat facing the savanna. It is climate change which presents perhaps the greatest natural threat.
• Rainfall change and variability is very likely to lead to a reduction in cover and productivity in the southern African savanna. Evidence suggests that there has been a drying trend of about 8 mm/yr since 1970.
• Large-scale changes in savanna vegetation cover may also result in reduced precipitation. Modelled removal of savannas from global vegetation cover has larger effects on global precipitation than for any other biome and has resulted in 10% lower rainfall.
• Trees and shrubs show higher CO₂ responsiveness than grasses and herbaceous plants. Savannas may thus be shifting towards greater tree dominance as atmospheric CO₂ rises.
• The proportion of threatened mammal species may increase
to between 10% and 40% between 2050 and 2080.

- Human impacts are also likely to feature. Some may note the unintended impacts of human attempts at more sustainable farming practices. Water conservation strategies such as dam building can create large areas of flooded land; a practice which is highly damaging to the local ecosystem. Cattle grazing is also likely to feature. The domestic animals are competing with the same food source as the natural wildlife. Big game invariably suffers as a result.
- Other activities such as farming plantations, human settlement, mining, hunting and poaching are likely to feature in responses as examples of human activities with a seriously detrimental impact on the environment.
- Some may challenge the statement in the question. There are examples of good conservation strategies in the savanna which are designed to protect the delicate balance between people and the environment. Relatively new economic activity such as tourism could provide a viable future for large parts of the savanna.
- Any conclusion is acceptable if it is firmly rooted in the preceding content.
### Marking grid for Question 6.8

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| **Level 3** (11–15 marks) | - Clear evaluative conclusion that is based on knowledge and understanding which is applied to the context of the question. Interpretations are generally clear and support the response in most aspects (AO2).  
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- Generally clear evidence of links between knowledge and understanding to the application of knowledge and understanding in different contexts (AO2).  
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- Generally clear awareness of scale and temporal change which is integrated where appropriate (AO1). |
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- Some evidence of links between knowledge and understanding to the application of knowledge and understanding in different contexts (AO2).  
- Some relevant knowledge and understanding of place(s) and environments which is partially relevant (AO1).  
- Some knowledge and understanding of key concepts, processes and interactions and change. There may be a few inaccuracies (AO1).  
- Some awareness of scale and temporal change which is sometimes integrated where appropriate. There may be a few inaccuracies (AO1). |
| **Level 1** (1–5 marks) | - Very limited and/or unsupported evaluative conclusion that is loosely based upon knowledge and understanding which is applied to the context of the question (AO2). Interpretation is basic.  
- Very limited analysis and evaluation in the application of knowledge and understanding. This lacks clarity and coherence (AO2).  
- Very limited and rarely logical evidence of links between knowledge and understanding to the application of knowledge and understanding in different contexts (AO2).  
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